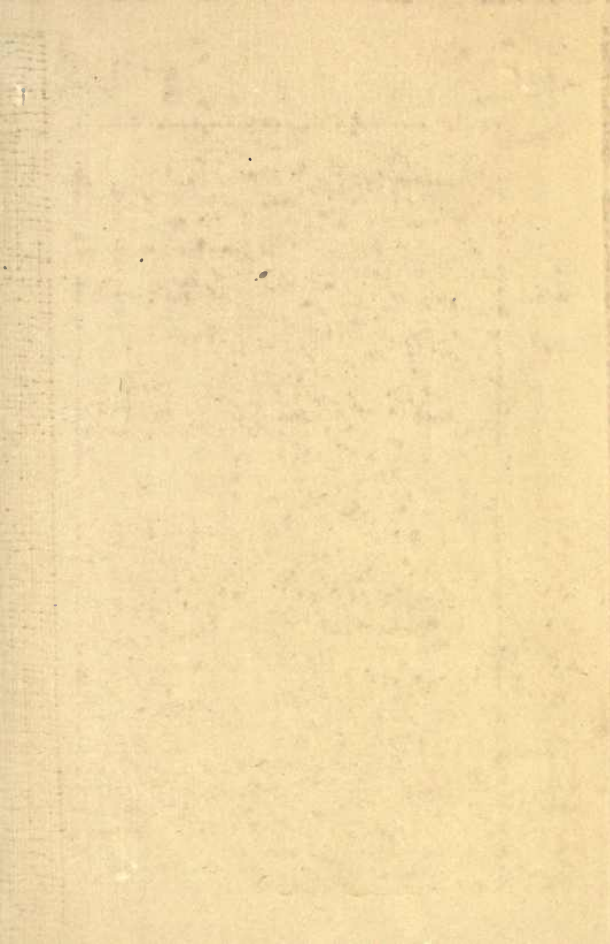


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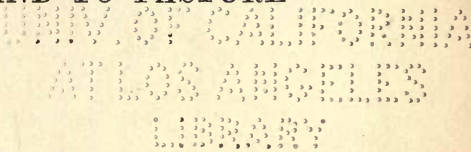
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AUTHOR OF "FARM BUILDINGS," "TILLAGE AND IMPLEMENTS,"
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CONTENTS.

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HARDING

CHAPTER I.

PAGE

THE INFLUENCE ON FARMING, STOCK-KEEPING, AND THE NATION	1
--	---

CHAPTER II.

THE FUTURE OF AGRICULTURE	21
-------------------------------------	----

CHAPTER III.

SUITABLE GRASSES FOR PERMANENT AND TEM- PORARY PASTURES	39
--	----

CHAPTER IV.

PERMANENT PASTURE	61
-----------------------------	----

CHAPTER V.

TEMPORARY LEYS	81
--------------------------	----

CHAPTER VI.

LAYING DOWN LAND TO TEMPORARY PASTURE .	100
---	-----

433374

CHAPTER VII.		PAGE
MANAGEMENT OF TEMPORARY PASTURES . . .		119

CHAPTER VIII.		
UTILIZATION OF THE CROP		137

CHAPTER IX.		
GENERAL PRINCIPLES ASSOCIATED WITH PER- MANENT PASTURE-MAKING: INFERIOR GRASSES AND WEEDS		156

CHAPTER X.		
THEORIES, EXPERIMENTS, AND PRACTICES RE- LATING TO PASTURES		174

THE CONVERSION OF ARABLE LAND.



CHAPTER I.

THE INFLUENCE ON FARMING, STOCK- KEEPING, AND THE NATION.

THE feature about Britain which most strikes the foreigner when he first comes to England is the garden-like and well-cared-for appearance of the country. Centuries of care, hard work, skill and enterprise have been bestowed on the land, and out of forest and waste neatly-arranged fields have been developed,

2 *The Conversion of Arable Land*

supporting commodious homesteads, villages and towns, all of which trace their origin to the produce of the fields. Perhaps there can be no more bitter reflection to an Englishman when he passes through the country than the knowledge that the work laid down by his fathers must to a great extent be abandoned ; for with all our apparent prosperity, the land, the great workshop of the country in days gone by, can no longer be cultivated so as to give its full return. Not that the land cannot produce what it did, and not that those who would work it have less skill than of yore, for at no time in the world's history has there been so great an accumulation of skill and knowledge among farmers as that held by British farmers to-day ; but because countries more favourably

situated produce grain more cheaply than it can be produced at home, no matter what skill is brought to bear upon it. Grain is the mainstay of agriculture, because on the extent to which it is grown depends the quantity of land left at the farmer's disposal to crop with other products for which there is only a limited demand, and on which but a slight increase in production reduces the profit so as to render them unremunerative to the grower. This stage has been reached in England.

The unprofitable condition of agriculture has been realized by most people for some time past, though perhaps nothing has more clearly expressed it than a paper read by Mr. Martin Sutton at the Farmers' Club, where, when dealing with the necessity for converting arable

4 *The Conversion of Arable Land*

land to pasture, he brought forward many causes which had tended to reduce it to its present deplorable condition, and gave sound advice to farmers for alleviating the losses they now sustain. Mr. Sutton pointed out that it was to pastures—permanent in some instances, temporary in others—that the farmer must look for the lightening of his expenses. If this good advice were followed, there is reason to believe that the farmer would lose less; but it must prove a serious blow to the labourer, and the country would be the loser to a very considerable amount on every acre diverted from arable culture, small as the annual return from an acre of grain is at present prices.

How vast the change which has taken place in farming within a quarter of a

century actually is, was pointed out by Mr. Sutton. In Great Britain the total cultivated area is returned as 32,629,855 acres, of which 16,405,069 acres are given as pasture, and 16,164,786 acres as arable—an increase of permanent grass from 1871 to 1894 of 4,392,213 acres. A footnote in Mr. Sutton's "Permanent and Temporary Pastures" gives information that is not obtained from official returns. "It must unfortunately be admitted that a proportion of this vast acreage has been allowed to go to grass, unaided, in consequence of the inability of owners or occupiers to cultivate the land." In this is much truth. A large proportion of the land that has been withdrawn from cultivation "tumbled down." It was exhausted of fertility so long as any sort of grain crop

6 *The Conversion of Arable Land*

could be got off it; the crops feebly struggled against the weeds, and finally, perhaps after a wet winter, when it lay water-logged in the spring, it appeared hopeless to do anything with it; it was therefore left for nature to deal with, and it has lain there ever since growing couch and other weeds, but little of such grasses and herbage as entitle it to be called permanent pasture. Very often this was land that for fifty years had a paid rental of from twenty-five to thirty-five shillings per acre, but which now is not worth the rates, taxes or tithes, to which it is subject—in fact it cannot be let to pay. The increase in cattle and sheep is in no way commensurate with the large increase in the acreage of grass; and this is the more striking when it is remembered how enormously the im-

portation of feeding stuffs has increased. The fact is the farmer has been losing money all round; he cannot stock the land to the full; the cattle have to go to pay other expenses, and he cannot restock.

It is doubtful if there is any increase in the output of meat due to those additional four and a half millions of acres of grass beyond that which could have been raised without them, with the aid of the imported feeding stuffs. The country is under-stocked from end to end, and had the previously existing pastures been fully stocked, and the feeding stuffs been devoted to animals carried on them, as much meat would have been raised. Meanwhile those pastures would have been improved, and rendered capable of carrying still more

8 *The Conversion of Arable Land*

stock in the future. Our own idea is that far more than the present head of stock might have been carried without the assistance of one acre of that four and a half millions, and also without the aid of by far the larger part of the imported feeding stuffs. The country is therefore losing the four and a half millions of acres. Under the old four-course system farmers used to say that to make a fair living (and they reckoned 1*l.* per acre per annum a fair return) the two corn crops should each give 10*l.* per acre. This is 20*l.*, without taking into consideration the root and seed crops. Putting the expense of the cleaning and thorough working of the land necessary to take it through the rotation against the value of the root crop; and allowing two tons of hay, at 3*l.* per ton (not overmuch for a

crop which can be cut twice in a season), the farmer could handle 26*l.* in the four years, or 6*l.* 10*s.* an acre throughout his farm. To the country the full value of the root crop had to be considered even though the farmer may not have made a penny profit from it—although of course he often made a considerable sum by the consumption of the crop. The country got the benefit from it, because practically all that went to produce it was the outcome of labour and the soil, as there was little purchased from abroad. A twenty-ton crop of roots would feed 400 sheep of eight stone weight for 400 weeks; this at 4*d.* per week gives over 6*l.* 10*s.* per acre; consequently the return on the rotation was 33*l.*, or 8*l.* 5*s.* per acre per annum. At this rate the four and a half million acres withdrawn from arable

10 *The Conversion of Arable Land*

culture, and set to grow grass to support animals which, had the farmer's capital not been exhausted through the unremunerative condition of other portions of his calling, could have been supported on the pasture existing previously to their withdrawal, entail a loss of over 35,000,000*l.* per annum. Not an inconsiderable loss even to a wealthy country.

It may be urged that we have had the largely increased importation of feeding stuffs to help us, but they have helped us very little in regard to output. The country paid a pound for every pound's worth imported. We lose the arable cropping, and gain little, if anything, in output of meat, notwithstanding the increase of pasture and of feeding stuffs imported. Perhaps one of the most hopeless features in connection with land

going to grass is that there were 350,000 fewer cattle, and 1,400,000 fewer sheep in the country in 1894 than in 1893, notwithstanding the fact that feeding stuffs were imported at a lower price than at any previous time. It does not appear from this that farmers benefit from the cheap importation of feeding stuffs to so great a degree as some would have us suppose.

And yet with good reason farmers are advised to change their system of farming, and turn their arable land to pasture. When it comes to such a state of affairs that the best remedy is to turn from the greater evil to the less, things are indeed bad. The great drawback to turning arable land to pasture is that farmers have been top-weighted by foreign competition so severe and so long continued

that only a small proportion are in a position to reap advantage from it. The want of capital to stock the new grasses must effectually check many who would from doing it. Where is a man, already pressed, to find the money to stock from 20 to 100 acres? He could, perhaps, work the land with fewer horses, less labour, less machinery; he may sell some of his horses and machinery, but they will not go much farther than the expense of seeds for laying down the land. Rent, rates, taxes, and a whole lot of incidental expenses will remain, so that he has little to turn into cash to make purchases. As things go he sees nothing before him but a gradual loss of capital. It is only those with capital at command who can hope to reap full advantage from the change.

Taking all things into consideration an acre of well-farmed land returns to the farm labourer 30s. for the work he does on it. As many pence are sufficient where the land is under grazing, as the farmer can do practically all that there is to be done except on special occasions. Assuming that four and a half million acres of land have gone from the plough to grass, and that this is grazed, the agricultural labourer loses 6,000,000*l.* yearly. Is it any wonder that he leaves the rural districts, and goes directly or indirectly to swell the ranks of the unemployed in towns? The loss in amount of wages is not only felt through the quantity of land turned to grass within the past twenty years, but the want of capital prevents farmers from employing all the labour they would on

that portion still under cultivation. A lighter labour bill, whatever its consequences, becomes a necessity when ready money is not available, and saving in this outlay is easily effected. Fewer hands are employed, less work is given to the land, and doubtless comparatively few farms carry the hands they did in the days of prosperity. On the sixteen million acres still under arable cultivation in Great Britain the smaller amount of labour employed on each acre must represent some millions of pounds less going into the pockets of the labourer yearly.

Sixteen million acres remain in the balance. Will this go also? Grain, meat, vegetables, anything the English farmer can grow, can be supplied from abroad at a cheaper rate than he with

English handicaps in the way of rates, tithes, taxes, and other necessities requisite for the support of a high-class shop-keeping nation, is able to produce them. If we take each important item the position is easily seen. In grain we are badly beaten. In meat we are running at such a low margin of profit that last year the decrease in cattle was 350,000, in sheep 1,400,000. Recent advices say that the Argentine is preparing to send carcasses, equal to those imported for 18*l.* from North America, at 12*l.*, so the future profit looks doubtful to us. Already milk, hitherto considered unimportable, is a daily arrival. Butter, and its poor relative, margarine, are coming in ever-increasing quantities, so dairying does not look so very hopeful. Potatoes, we have recently been told, are

more promising because the English farmer imports comparatively less than he did. We, however, fail to see great cause for rejoicing. In 1878, the year before the depression in agriculture is generally stated to have commenced, 508,000 acres were grown; in 1894, 504,000 acres. The greater freedom of cultivation which has opened up an almost unlimited extent of land suitable for potato cultivation, has not increased the acreage. Granted that some improvement in the cultivation and in the varieties grown has taken place, resulting in a greater yield, there is no reason to suppose that this has increased abnormally within the past fifteen years. There were Champions and Magnum Bonums in those days. What has occurred is that the increase in supply

has been sufficient to keep the markets in an over-supplied condition, and except in years when, through disease, frost, or other exceptional reasons, prices have received a special impetus upwards, the normal price has not been sufficiently good to induce the foreigner to grow main-crop varieties with the view of putting them on our markets. If it does not pay the foreigner with cheap sea-rates, free importation, cheap labour, and lower taxation, to grow them, it does not pay the English grower. The satisfaction the English grower gets out of the luxury of supplying potatoes that once were supplied by the foreigner is therefore not very great, especially when he remembers that the early potatoes, which are those which would be most remunerative if his climate would allow him

18 *The Conversion of Arable Land*

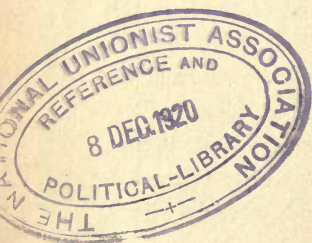
to produce them, are imported, so that he loses the very high prices which once were his. Altogether it appears to be a sort of negative satisfaction. The exceptional prices of 1895 were due to the May frosts, disease, and the winter frost, a combination of circumstances which rarely occurs. We do not say that under ordinary circumstances all the half million acres of potatoes are grown at a loss, but a great proportion are. Those who grow the choicest varieties after the best methods naturally do best, as they realize the highest prices, but the demand for the best is more or less limited.

The palmy days of market gardening have to a great extent disappeared owing to increased home and foreign competition.

No matter to what the farmer turns to help himself, he is only catering for an already over-stocked market. A few more chickens and eggs and a few more specialities are well enough in their way, but very slight increase in the supply of any one rapidly reduces them to the point where no profit is reached. As things go, according to the experience of those most intimately concerned, a large portion of the sixteen million acres of arable land still being worked is losing money. If it continues to lose, it must cease to be worked. At 6*l.* per acre this practically means that 100,000,000*l.* annually would be withdrawn from the income of the country, almost all of which is absolute profit. With it goes all the capital represented in the improvement of the land, in its buildings,

20 *The Conversion of Arable Land*

cottages, &c., a sum not well comprehended. Turn it to grass. Some of it may be saved in this way, but in providing more food for stock, and raising more meat, the question arises, What price will meat fetch when more meat is produced? What is to prevent grass from being over-stocked when already there is so much under-stocked?



CHAPTER II.

THE FUTURE OF AGRICULTURE.

THE future always leads one forward more hopefully ; if it does not, things are indeed in a bad way. Whilst there is any glimmer of light through the mist, hope is ready to see it in a brighter day beyond. The present is always with us ; the future never comes ; but hopes may be realized in the future. It is certain that existing circumstances cannot carry British agriculture far into the future. There must be changes. The changes will have to be made both by the farmer and by those who do not farm. The farmer must make his business one in

22 *The Conversion of Arable Land*

which the outgoings are reduced to a minimum. There was a time when a man who made two blades to grow where one had grown before was considered a patriot. Now, one class of patriot has come to the conclusion that the land is of so little importance that it must "go." A ray of hope is that, with greater knowledge of the benefits a nation receives from its land, this class of patriot will become smaller, and that those who realize how badly agriculture fares, and how serious its loss would be to the nation, will give it their practical support. The farmer in his lights has been doing his best to adapt himself to the changing circumstances. The strong prejudices which were the stock arguments of not many years ago, have disappeared almost entirely, and are only

found in those districts where nature has been kinder in the disposal of soil and climate, and in providing the soil with breeds of cattle or sheep peculiarly adapted to it. We know a few such districts; in these the extremes of climate have not been felt throughout the past fifteen or twenty years in anything like the degree that has been experienced in the greater portion of the country, and here men have been able to continue their prejudices without suffering in the same way that those less favourably placed have done. As a rule, however, farmers have realized that there is no harm, and nothing which injures their business reputation, in going outside the beaten track. Those who have best faced the times have struck out in fresh directions, and others see that they must do

so also. Without losing any of their general astuteness, farmers have changed in a remarkable manner, and with anything like encouragement they are prepared for further change, though, with the ever-increasing supply of foreign produce, it must be patent to those who know little of farming, that the inducement to effect change is hardly sufficient to make them enthusiastic about it. Changes cannot be effected on the farm without considerable outlay of capital, or the waste of existing capital, any more than a draper or milliner can change his business to a tailor's, or an ironmonger his into a wheelwright's. If, then, farmers are a little slow in making changes, it is now more often due to the exercise of business caution than to ignorance and prejudice.

There is little doubt that alterations are frequently not made because of the terms of the agreements farmers hold with their landlords. It may be urged that in these days landlords are glad to let their land on any reasonable terms, so long as they can get a rent. There is a great deal of truth in this, especially where it affects poor landlords. There are, however, landlords holding even large estates to whom it is not a matter of serious issue whether they get any profit from their estates, but who hold the peculiar notions with regard to farming that they inherited in bygone days, and these are not men with whom it is easy to get a change of lease. Then, again, a farmer may be in a bad financial position, and not well equipped to make terms favourable for himself. In fact,

26 *The Conversion of Arable Land*

there are thousands of farmers holding leases and agreements they signed years ago, which include clauses they would like altered, but which from causes best known to themselves they prefer not to urge. A man may effect various permanent improvements on the farm; among them he may put down land to pasture; he may treat the land fairly as between tenant or landlord; he may do no injury to it; yet when he presents his claim for unexhausted improvements, a counter claim is put in on the ground of breach of contract in accordance with his agreement. The breach may be that he changed his cropping—had not such and such a proportion cropped in a particular manner. He may have been doing it for years and no objection have been lodged, but, although he has done

no harm, he must sacrifice that which he has done for the permanent good of the farm he is leaving.

It is this which has caused the recent Agricultural Holdings Acts to be such a dead letter. While guarding the landlord's interests so that malicious injury is not effected, it is important, in view of the greatly changed conditions of farming, that items in these musty leases which are prejudicial to both landlord and tenant should be dispossessed of the power of preventing tenants from turning the land to better account. In the long run it would be better both for the landlord and the tenant. Doubtless many thousands of acres out of cropping to-day would have been paying substantial rent if the tenant had felt he might exercise his own judgment, and

change his system of farming without incurring serious liability by so doing. The landlord should, of course, be guarded against the unscrupulous squatter who steps into a farm to exhaust it of any available fertility, and then moves on. If tried tenants had been allowed to make the changes that their experience with the particular land warranted, and had not been tied hard and fast to leases possessing no elasticity to meet altering circumstances, it would have been far better for the landlord. The absurdity, and want of business principle in providing one form of lease to meet the varying conditions of land—hill or valley, clay or gravel—which existed on some large estates are so apparent that it is evident that such dealing could only have been instituted

at times when competition for land was very keen, and men were careless what they accepted so long as they could get the land.

Farming has been too princely. In this we mean there has been too great expenditure in directions where corresponding returns could not be expected. "Model" farm buildings have been responsible for much unnecessary outlay. Perhaps one of the worst days' work an ambitious man has had has been when he has been taken to look at a show-farm, where everything about the premises had been arranged with perfect taste and judgment: Halls for cattle, boudoirs for dairies, palaces for stables, neatly-furnished cubicles for piggeries, enlarged dolls' houses for poultry, and everything in the same proportion. Very

pretty to look at, but nothing that money—if there is plenty of it to waste—cannot buy. Anybody can have such a place if he will spend the money on it; but what purpose does it serve? It does not indicate good farming any more than does growing big crops by extravagant outlay. The unfortunate part of the matter is that both these forms of extravagance have been too often regarded as indicating skill, and have had many imitators. The fact of the existence of these “model” homesteads was bad, because it bred the desire for something on the same lines, and to satisfy the demands of their tenants landlords had to play a sort of game of brag as to who could go farthest. That many went too far is known only too well on estates in all parts of the

country. Something more simple could have been contrived which would have answered the purpose of the farmer equally well.

Fattening cattle beyond a certain degree has been a source of loss, almost, though certainly not quite such a source of loss as selling them as fat when they were only three-fifths fat. However, it is not always for want of judgment, but because necessity wills, that a farmer sells his stock at the time they are entering on the most profitable phase of their existence. There is no excuse for the man who makes blubber in days when candles are displaced by gas, oil, and electricity. He simply indulges his own vanity, and of course he must pay for it. Cattle, and all live stock, require to be fat to fetch the best price, but

beyond a certain condition their food is wasted. It is not good farming to make animals fatter than they can be made so profitably. There was some excuse in the days when wheat was fetching 3*l.* per quarter, as, with moderate tillage, dung made by extravagantly fed animals was likely to produce wheat in return which would show a profit. The lower the price to which wheat falls the less inducement is there to make dung by extravagant means, as the dung is used to raise lower-priced crops.

The future of farming must involve carefulness in every direction. Luxurious notions must be allowed to slide. A change from arable land to grass will render many of the princely homesteads unsuitable for the new conditions. These homesteads will have to be converted into

more suitable farms, each according to its present accommodation and the extent to which the system of farming is altered. It is unreasonable for farmers to expect that landlords will make great outlays; and farmers must be satisfied with such reasonable changes as will allow them to carry on their business. Little inconveniences must be overlooked, and everything turned to the best account. Barns may be turned into suitable cattle byres or sheds with very simple fittings. Central feeding passages with tram rails, &c., may be done without. An ordinary floor manger, with simple ties, is all that can be asked reasonably for. There is not much that English farmers have to learn from Irish farmers, but after seeing the extravagant feeding houses in England, the interest

on the outlay of which often amounts to the profit of several bullocks, one cannot be otherwise than struck with admiration at the large number of cattle that are conveniently, comfortably, and profitably housed in the inexpensive simply-fitted sheds which are met with on moderate-sized farms in some parts of Ireland. Different indeed are these to the general run of cattle sheds in England. Such princely cattle halls as that at Bemerton, near Salisbury, are of course exceptional, but the waste of building a house at the cost of two or three thousand pounds, to hold eighty or ninety cows, cannot be too strongly deprecated. In this case, from 25*l.* to 30*l.* was spent to shelter each animal. Very few have considered how much is spent per animal on a large number of the high-class homesteads in

England. If they did, they would be much astonished. Therefore, we say, in making alterations in premises, it is necessary to exercise great caution in respect to the outlay, especially as there is a vagueness as to the profit which will be realized in the new order of things.

A change in cropping from arable to grass tends in one important direction, that of reducing the heavy cost of carriage of produce. When the produce can walk to market, instead of being carried there on wheels, a saving is effected. There are times when carting can be done with but little expense to the farm, but such times are exceptional. It cannot be too readily remembered that when once anything is put into a cart expenses commence with it. It is greatly

36 *The Conversion of Arable Land*

in favour of mixed farming, even when the tendency is strongly on the side of grass, that the corn grown upon the arable can be fed with great advantage on the grass. Instead of carting corn to market, and carting back another form of feeding stuff, that which is at home is saved the cost of cartage, and the profit of the buyer of the corn and the profit of the dealer on the feeding stuffs are saved.

The excessive charges of railway companies check the profit the farmer would get, as the preferential rates at which foreign produce is carried act as a handicap to him. It is distinctly unfair for railways to do this; it is harder because proportionally railways are lightly rated, and it is still harder because railways, which pay so little

towards the school rates, obtain the services of young men and lads who have been educated almost entirely at the expense of the English farmer. A gleam of light is that sometime railway rates will be adjusted so as to render matters fairer towards the farmer.

Light railways are held out as a boon in the near future. There are some districts where such railways would be a decided gain, but, as a rule, the larger railways have tapped the districts where any considerable amount of carriage is to be obtained. No one, of course, would refuse to have a railway brought close to his door, if he paid only a slight proportion of the charge, but it is emphatically unfair to tax others so that he may be more conveniently situated. Before rushing into a wholesale system of new

38 *The Conversion of Arable Land*

railways, the most important step appears to be to ascertain whether the land throughout the country within three miles of a railway is in a paying condition. If not, what good is to be expected from opening up other districts? What under-supplied market are they going to supply, when all markets are already overstocked? Anything additional will only tend to lower them. Light railways will not in themselves make English agriculture prosperous.

CHAPTER III.

SUITABLE GRASSES FOR PERMANENT AND TEMPORARY PASTURES.

HAVING reached the point where we must begin to deal with the methods of treatment of arable land which is to be converted into grass, it is advisable to detail a few of the features of the plants which are found most suitable for that purpose. The descriptions will be brief because the characteristics must be dealt with when treating with mixtures suitable for particular purposes.

RYE GRASS.—The Italian and the Perennial are the two species of rye grass

which deserve the greatest attention from the farmer. There are a great number of varieties of these grasses, especially of the latter, but for most practical purposes these two are all that need be considered, though for shortest leys the annual ryegrass is valuable as producing a large amount of feed in a short space of time. The Italian is biennial—sown in one season, it comes to maturity in the next, and produces a fair amount of growth the second year. True, some plants live on a year, sometimes two, longer ; but from a practical standpoint it may be considered of no value after its second year. In water meadows, especially on the edges of the grips where the soil is worn from time to time by the action of the water, it may be seen growing from year to year, but how far this is due to

seed falling on it, cannot be easily proved. For a single year's ley it is of the greatest value, coming into growth very early, and producing several crops in the season if it is cut each time as soon as it is well-grown, but not allowed to ripen its seed; producing, of course, most crops in a moist season; in fact, it so loves moisture that we have seen crops of it on the Bedford Irrigation Farm, measuring three feet in height, as the result of one month's growth. It grows on almost any soil. Mr. Sutton mentions that "fair results have been obtained from heaths dressed with marl and farmyard manure. It flourishes in warmth and moisture, and in rich damp soils the growth is extremely rapid. It starts earlier in the spring and grows later in autumn than any other grass"—a good record. When

42 *The Conversion of Arable Land*

it is added that all stock relish it, and that it makes excellent hay, it is not difficult to see that it is of the greatest value in short temporary pastures. When sown alone three bushels are required per acre, and it is best sown in February and March for spring seeding, in September and October for autumn seeding, though it may be sown at any convenient time from February to October, when desired. The seed, which is comparatively light, owing to the husk and long awn which prevents it settling down solidly, should weigh over 18 lbs. per bushel, improving in accordance with its weight up to 22 lbs. Care should be taken that it is free from seeds of inferior grasses, such as couch or twitch, tall oat grass, Yorkshire fog, the poorer brome grasses, &c., and of weeds,

such as crowfoot, rib-grass, docks, &c. The same obnoxious weeds should be guarded against in samples of seeds of all grasses, especially such as Perennial rye grass and Meadow Fescue, where, on casual observation, they are not easily recognizable, though they may be detected with little trouble if the sample is looked into closely.

To those who are not accustomed to look at samples of seed, and do not readily recognize foreign matter in them a small magnifying glass or lens proves of great service. A description of the seeds of grasses that should not be present in any sample, but which unfortunately are found too commonly, may help buyers to notice them. The seed of couch may be recognized from Italian rye grass, because instead of the awn

44 *The Conversion of Arable Land*

appearing to be an extension of the keel-like rib which runs along the back of the seed, the rib is much less marked, and the awn (as far as there is one) is only the husk which has shrunk and partly rolled itself up to a sharp point, and is not, strictly speaking, an awn at all. The seed of couch is longer, and gradually tapers to a point from near the base. The seed of the tall oat grass, which is also common in badly cleaned samples, should be looked for, as it produces the objectionable onion couch. It is much larger than the rye grasses, and may be seen on casual observation. It is very similar in appearance to a small wild oat. In colour it is usually brown on the back ; and out of the back, near the base, springs a stout long awn, about twice the length of the seed. This awn is

straight and spiral about half its length, after which it generally turns off abruptly. At the base are a number of fine hairs similar to those seen on the wild oat. The seed of the soft brome grass is often met with. It is a coarse thick seed with a short awn. Being twice the size of the Perennial rye grass, it is easily noticeable. The outer husk is coarse, and if the seed is viewed lying on its back the kernel appears to lie deep down in the husk. The kernel is somewhat flat and sole-shaped, and is covered by a thin skin which has strongly serrated edges. The seed of Yorkshire fog is very dissimilar to those before mentioned. It is short, and is surrounded by a thin husk of a light colour; under a small magnifying glass it appears to be similar in shape to a beech-nut which has partly

46 *The Conversion of Arable Land*

split showing the kernel inside. The two last-mentioned are largely sown when the sweepings of the hay-loft are used.

Permanent rye grass is admirably suited for long or short leys. A few years since there was a crusade against its being employed for permanent pastures, but the error of the advocates of its non-employment for this purpose has been shown, and it is rare now for any field to be laid down without it. We were victims to laying down fifty acres in three fields without it; two of those fields are under the plough again, after having given most unsatisfactory results. All round it is doubtful if we possess a grass of such great general value. Sown in a crop one year it produces great bulk in the following, and

does well, if manured, for two more. It then generally goes back, but this is usually for want of manure. On most soils it does not as a rule die out when sown in a mixture of seeds intended to produce firm pasture, but it grows less as the surface of the soil becomes exhausted of its manure ; the application of manure immediately causes it to spring up again to vigour. As the soil of a new pasture becomes enriched with the decaying roots of plants, the rye grass wakes up to use the fertility thus engendered, and as years go by it increases its hold again. As seen in the investigation of old pastures made by Dr. Fream, it almost always becomes the predominant grass in the best pastures throughout the country. It is most frequent in pastures carried on good rich soils, and is less frequent and

48 *The Conversion of Arable Land*

grows less robustly as the soils become thinner and dryer. On waterlogged soils it does not thrive. It possesses no feature which detracts from its value. It does not grow in coarse unsightly tufts ; it has a rich verdant green colour ; is highly nutritious ; gives excellent hay easy to make ; is relished by horses, cattle and sheep alike ; and forms a good turf above and below ground. The seed is sufficiently vigorous not to be smothered at seeding so readily as are some of the smaller seeded grasses, and is easy to harvest and to thresh. When growing, the plants of the Perennial and Italian rye grasses may be easily distinguished. In the case of the Perennial it will be seen that the young leaves are folded flat on the mid-rib throughout their whole length when emerging from the

purple sheath at the base of the plant; whereas in the case of the Italian, the young leaves curl round somewhat corkscrew fashion. When in ear, the awns of the Italian distinguish it from the awnless perennial. The best seed weighs from 24 lbs. to 28 lbs. per bushel. From 24 lbs to 26 lbs. is that usually sold as the choicest, and any extra weight is not of special value. From 22 lbs. to 24 lbs. is sound and good, but below that it cannot be relied upon.

TIMOTHY OR CAT'S-TAIL is another valuable grass for alternate husbandry, or for permanent pasture. It has increased in popularity of late years, though it has long been a favourite in America and Canada, whence a considerable quantity of Timothy hay has been sent to England during the past four or

five years. Sown in temporary pastures it gives a good return for several years. As it is essentially a late grass, it is not so suitable for use in a single year's ley to mix with clover, as it matures later, and Mr. Sutton recommends it to be sown with cowgrass, when the two will be at their best at the same time. It, however, makes coarse hay, which requires chaffing when the grass has been left late before cutting. Its hardness is a strong point in its favour. If late in maturing, it affords nutritious autumn and winter grazing. When mown with the view of getting good aftermath, it should be cut early. It is particularly suitable for clay and moist soils, and luxuriates in peat soils. The seed, which readily falls from the husk, weighs 50 lbs. per bushel, and it is very

easy to detect foreign matter or weeds in it.

MEADOW FOX-TAIL ranks first as a permanent grass, though it does not come to maturity sufficiently quickly for its value to be obtained in short leys. A somewhat similar grass—the black-bent or mouse-tail—resembles it only in outward appearance, for instead of being highly nutritious and capable of producing abundant herbage, it is one of the worst pests on heavy arable land, and has no feeding value. Several other grasses belonging to the same family resemble it in the flowery head, but have no value to the farmer. Meadow Fox-tail comes into flower as early as the middle of April, and produces so much herbage early in the season, that fields in which it is plentiful are always amongst those

on which farmers can turn their most forward stock as they are fit to seed sooner than those where it is not so plentiful. It does not do its best except on rich moist soils. One of the richest fields we know, in the parish of Thorney, near Peterboro', is composed to a great extent of this excellent grass; the soil of this field is rich fenland resting on clay. On burning soils it makes very little show, but where circumstances are favourable to it, that is on all good soils, it is the most highly-prized grass we have. The seed is light, the heaviest samples not exceeding 12 lb. per bushel, and is more often obtained at eight or ten pounds. Being small and light, it requires careful seeding, as if buried deeply it will not germinate.

MEADOW FESCUE is a valuable grass,

but it rarely appears to form a large portion of the grasses in a pasture. It was very much boomed a few years ago, and was strongly recommended by its supporters as being better suited than perennial rye grass for sowing on land to produce permanent pasture. There are many reasons for supposing that those who advocated it mistook the herbage of rye grass for meadow fescue, which it somewhat resembles, though the marked midrib down the rye grass is only slightly marked in the meadow fescue. Nor is it preferable to rye grass in temporary mixtures. It is, however, the most valuable of the broad-leaved fescues, of which the various-leaved ranks next. There are many narrow-leaved fescues, the Hard Fescue being the best among these. It is well worth a place in a

mixture for most soils, for if it establishes itself it provides valuable food. It is found on almost all sheep pastures, often occupying an important place in them. Sheep's Fescue grows freely on Down land, and is found largely among the sheep pastures of the Highlands. It is unimportant in rich pastures as it is shouldered out by stronger varieties, it being the smallest of cultivated grasses. Though small it is nutritious, and it thrives on poor, thin soils, such as those mentioned, where no other grass would give so good a return.

ROUGH COCK'S-FOOT is a valuable grass for either temporary or permanent pasture. On dry soils and in dry climates its growth is stunted, and an objection is often lodged against it that it produces a tussocky form of growth

which is unsightly in newly laid pasture. My own opinion of the value of the grass has been greatly raised by seeing what a prominent place it takes in the best Irish pastures. Even on comparatively new ones it proves valuable. The tussocky habit of growth disappears when the pasture becomes well established, as instead of keeping in a bunch it ramifies through the turf and mixes well with other grasses. It is exceedingly well suited to temporary pastures, where its great growth of rich feeding grass proves very valuable. In hay it is coarse, and should be cut early ; and its coarseness makes it rather a farmer's than a market hay. On dry soils it should be sown in small quantities, but on rich moist soils it may be sown more abundantly. The seed weighs 18 lbs.

per bushel and possesses considerable vigour.

ROUGH-STALKED MEADOW GRASS and smooth-stalked meadow grass are the two *Poa* grasses found most useful. Mr. Sutton recommends the former for strong moist soils, and the latter for drier soils. They are not well suited for temporary pasture. The grasses are very similar in appearance, and the only reliable point of distinction is the shape of the ligule. In the smooth variety it is rounded, in the rough pointed.

DOG'S-TAIL is found so frequently in old pastures that it cannot be so valueless as some would have it estimated. It is found on our pastures of moderate feeding value, but it is there because the amount of fertility in the soil will not carry the better grasses. By doing away

with the dog's-tail, room would not be made for grasses which would give a better return. The fittest stand. Manure the soil to encourage better grasses, and the dog's-tail will be less in evidence. It makes a good bottom, and helps to form a turf of roots. As a portion of it goes to seed when grazed, there is no need to sow it thickly, as in course of time it will spread to the required degree.

SWEET VERNAL is a grass of low-feeding value. It, however, takes up small room in a pasture, and, as it possesses more than any other grass the peculiarly sweet aroma of new hay, it is valuable in hay as imparting to it a pleasant smell.

FLORIN, or Creeping Bent Grass, is valuable in moist situations, but it is

58 *The Conversion of Arable Land*

practically valueless in dry places. Other plants of the family *Agrostis* are weeds, and useless.

The CLOVERS most valuable for farm purposes are the red, white, alsike, yellow and cowgrass. The red is especially valuable for temporary leys, and may be sown in quantity in mixtures for permanent leys. Cow-grass, which is often regarded as only a variety of the former, is more perennial in growth. It is known as a single-cut clover, as it comes to the scythe but once in a season, whereas broad produces two, and we have taken three crops in a wet season. White clover is unfitted for hay as it rarely grows tall enough, but it produces thick herbage of a most nutritious nature. Sown by itself, or in temporary pastures, it is very valuable,

and there are few really valuable permanent pastures where it does not form a considerable portion. Trefoil is not of great value, though it has its place in temporary mixtures on thin soils. Alsike is a single-cut clover, growing a big crop for a year or two. It is often sown in permanent mixtures, but is rarely found in established pastures.

SAINFOIN AND LUCERNE are two extremely valuable leguminous plants, particularly for soils where lime is present in the subsoil. They may be laid down alone with great advantage, or may be sown in temporary mixtures. Well cared for, a crop of either will stand many years, but if they die out from exhaustion it is no use to plant the same land with them again for some time. Lucerne is the Alfalfa of

the Argentine. There is a great and commendable increase in the quantity of these crops being sown, lucerne especially thriving without a chalk subsoil, once thought essential. We have seen a ten-year ley as good as ever after ten years' cropping on fen peat resting on clay, and have seen a twenty-year ley on a mixed light soil in Norfolk.

CHAPTER IV.

PERMANENT PASTURE.

A PERMANENT pasture, as distinguished from a temporary pasture, is grass land which has reached that stage where there is a kind of turf of grass above ground, and a turf of roots below. Until the roots form into a matted turf of at least one and a half inches, the characteristics of permanent pasture are not shown above ground. In a temporary pasture the individual plants as sown are distinguishable ; in a permanent pasture they have merged together so that it is difficult, in very old pastures impossible, to detect which blades belong to particular plants. The roots in a temporary

pasture are but thinly collected, and the soil about them has changed little in colour. The roots of an old pasture continue to be matted together to a depth of as much as six or eight inches at times, and the colour of the soil has darkened from the decay of previous generations of roots. The age of pastures may be approximately arrived at if the sod is examined. On gravelly land, no matter how many stones there are on the surface when the seed is sown, these are gradually buried by the matting of the roots and the growth of plants above them ; worms too are continually at work passing the herbage through them, thus bringing the undigested portion to the surface and there leaving it in the form of worm casts. The immediate surface soil thus becomes completely altered. A

large amount of fertility becomes stored in it from time to time, and this becomes available for the use of succeeding generations of grasses.

The difference between permanent and temporary pastures is this: Temporary pastures have to rely entirely on the soil for support. Permanent pastures are able to find additional sustenance from the food collected, which is in the form of humus or decayed vegetable matter, this being the remains of previous generations of grasses grown there. It is for this reason that old pastures are said to be self-supporting. This is true only in degree. On very old pastures so much fertility is stored up that the omission to apply manure is not strongly marked for a year or two; whereas the omission in the case of a

temporary pasture is at once apparent. It is obvious that the storing of fertility can only be done at considerable cost, and it is here that the expense of making a pasture is directed. Break up the pasture, and set free the stored-up fertility, and then the extent of the storage becomes apparent. In making a pasture, therefore, it is necessary to store up fertility. The longer the pasture is down, the greater is the amount of fertility stored. Even in a short ley an appreciable amount of fertility is stored away, and the setting free of this renders it unnecessary to apply heavy dressings of manure to support a corn crop—one of the points in favour of temporary leys. When once a pasture is self-supporting—though this must not be traded upon too much—it is found that for a small

outlay a big return is made, provided, of course, that drainage and other matters are attended to. But it is not reached without considerable outlay at first. At these times, when it is necessary to avoid outlay, the value of permanent pasture is understood. It is to be regretted that there is such a large proportion of existing pastures in a less prosperous condition than they should be, through want of better and more generous treatment.

The laying down of arable land to permanent pasture is a simple act in many ways, but the want of success attending the labours of many who try to bring it about shows that it is not altogether an haphazard performance. The widely different circumstances which have to be dealt with in preparing a soil

such as is found on thin chalk downs, and one found in the heavy clay districts, point to the necessity of practising different methods. A difficulty in connection with laying down permanent pasture is that you do not necessarily reap what you sow. A permanent pasture grows just that herbage which the particular form of fertility, the mechanical and chemical condition of the soil, and the climate, are capable of producing. The aim should be to reach the point where the pasture becomes permanent, with as little loss and as much gain as possible. The experiments at Rothamsted and Kidmore show that the nature of the herbage on the same soil, and existing under exactly similar conditions, can be entirely changed by the application of the comparatively few

pounds' weight of artificial manure applied annually. On a larger scale the same thing is seen in the fields around us. Two fields lying alongside each other often show great difference in the grasses which go to make up their pasture. One which has been generously treated carries grasses which are capable of fattening a bullock per acre, while the other, exhausted by frequent mowing and unaided by manure, will hardly carry a yearling. The grasses in these two fields differ entirely. Each supports the varieties it is capable of carrying. If the poor field is subjected to manuring, the poor grasses are driven out by the better; if the rich field is subjected to an exhausting process for a few years, the higher class grasses become stunted, and the poorer grasses increase and smother

68 *The Conversion of Arable Land*

the good ones. In practice good pastures usually keep good, because, if any animals receive extra food whilst grazing, it is those which are nearest to the butcher; the poor keep poor because they get no help.

The reason why many fields are so slow in coming to pasture is that, before being seeded, they have generally been exhausted of their fertility—in fact, brought to such a point that they can only carry inferior grasses. When this happens, the efforts of the seedsman to supply good seeds are of little avail. All he can do is to supply sound seed of such character as seems most likely to suit the soil in its exhausted condition. The young plants come up and search for food; if there is none suitable they cannot prosper, whereas weeds and inferior

grasses thrive and choke them out. The seedsman can give a field the best possible start; the farmer holds the success of the crop in his hand. This must be borne in mind when making preparations for laying down. When seeds are sown in a cereal crop on land for some time subjected to an exhausting system of farming, there is little left for the young grasses to seize upon when the corn crop has taken out what it wants; it must be manured. In these times, when every penny is a consideration, men are loth to give up a crop which will give them a return, even though it is a small one per acre, and few will be induced to lay down the land from fallow. Unless a farmer can afford to manure his seeds during their early years, he follows a very doubtful method

in laying down the poor land with seeds in a corn crop. It is better to lay down in a green crop, such as turnips or rape. In this way the rent and part of the expenses of working the land are saved, as the root crop can be fed off by sheep, which will manure land. When this is practised the roots should be got in as soon as the land is ready for them. The seed should be sown broadcast, not too thickly, and the grass seeds should be put in immediately. If this is done, the latter will be well established by the time the roots are fit to feed. The treading of the sheep does good to the grasses, as the tightening of the surface conduces to their rooting more firmly. The sheep should not be allowed to feed off the roots too closely, and if a piece of root is left in the ground it soon decays, afford-

ing nourishment to the young plants which will quickly fill in the gap the root made whilst growing.

The preparation of the land for seed-ing varies of course in accordance with the nature of the soil and the conditions under which it is to be sown down. The object is to get a clean seed-bed with a fine surface. It is sometimes argued that because twitch, or couch, dies out of pastures in course of time, it is immaterial whether it is destroyed previously to the land being sown, or whether it is allowed to grow among the young seeds. If it were only because the hay from it would, through the ripened seed, contaminate the remainder of the farm where the hay is fed, it would be sufficient cause for its extermination ; but the fact that for some years it would

be taking up a large quantity of nourishment, and storing the greater part of its thick roots underground, where it would become but slowly available, shows the mistake in leaving it there. It is far better to kill it on the land, and let it lie, for if this is done it rapidly becomes food for the young grasses. It is better to leave it than to burn it, if it can be killed without burning.

A fine surface is necessary, because grass seeds are so small that they do not possess the power of forcing their way through a depth of soil; and also because, if deeply buried, they will not germinate at all. Very few grass seeds will grow where buried more than half an inch; therefore the surface must be both smooth and solid, otherwise the seeds slip between the clods, and, for

practical purposes, are lost. Discretion has to be used as to whether the seed shall be harrowed or rolled in. Several considerations regulate this: the condition of the surface with regard to moisture and roughness, the tendency of the land to bind, and the immediate probabilities of the weather, all require to be considered. On land which binds when rain falls on it after being freshly moved, the greatest care is necessary, for if rolled under such conditions it is liable to set and harden, so that when a spell of dry weather follows, the seeds sown often germinate and malt, after which, of course, they are useless. The aim should be to get the land worked and cleaned previously, then to get it in a fairly consolidated condition, after which the seed may be sown, and

74 *The Conversion of Arable Land*

lightly harrowed in by bush-harrows, or the lightest seed harrows. Sometimes the seeds are best merely rolled in, as in cases in which the surface lies in small clods which yield to a light roller, and afford sufficient covering for the seed in breaking down; however, except on very light land, rolling is dangerous, when there is risk of rain following immediately. Seeds are best sown by means of a broad cast machine, the ordinary harrow being well adapted for it. Except when a cup or force feed distributor is used, it is necessary to sow the coarse seeds at one operation, and the small ones by themselves in another operation. With the smaller seeds the clovers may be included.

The time for sowing seed depends on the circumstances under which the grass

is to be grown. If in wheat, they may be sown in February, or as soon as the land will harrow. On a firm wheat bed they may be harrowed freely. In spring corn they may be sown at the time of seeding the corn, being sown just before the last light harrowing. If the land is weedy, the corn may be allowed to get up sufficiently to permit harrowing or hoeing, and the seeds may be then put in. Seeds sown early in spring stand the best chance of establishing themselves before the summer droughts. When sown among roots they must be sown when the weather is favourable; it will be rather late and precarious, but not prohibitively so. Autumn seeding should be done in September or October; if left later, the plants stand a chance of being injured by severe cold.

As to mixtures suitable for seeding, better cannot be devised than those offered by the larger and more reputable seed firms, who supply the several varieties separately, so that the buyer may be satisfied that he is purchasing what he orders. The only reservation to this is that we do not recommend expensive mixtures containing an exceptional number of varieties. In most cases these have been devised to meet the idiosyncrasies of those who have taken a special fancy to particular varieties to the exclusion of others. The aim should be to get a mixture which, while producing a good head of grass in the first years, will be at the same time working towards the establishment of the pasture. The return of these years must not be altogether lost

sight of, even when striving to secure the permanency of the grass. Still, a few of the smaller and finer grasses may be included, so that if circumstances are favourable, or when the circumstances become favourable, they will have their chance of developing. Where the land is rich in lime, the quantity of clovers should be increased, as they are of the greatest value in a pasture, and soils which carry them freely are the quickest to become pastures, and are least expensive whilst so doing. In most cases pastures consist of a considerable quantity of clovers and grasses. Often the clovers seem to have almost entirely disappeared when the pastures have been down a few years, but as the conditions improve they generally come back again, and there is no better

78 *The Conversion of Arable Land*

indication of a turf having been formed than that the white clover has re-established itself. Before the white clover comes back, the yellow trefoil is at work, doing what it can to add nourishment to the soil. The land is not rich enough to carry the white clover, but gradually the trefoil has to give way, and in course of time, if the pasture is well treated, it disappears, or makes but little growth.

During the first few months coarse weeds should be kept down. If in a corn crop this must be restricted to pulling out weeds, such as docks. If sown alone on a fallow, the weeds may be brushed with a scythe. At whatever time sown, it is a mistake to let any plants seed, as they are weakened by so doing. Young cattle are excellent

feeders of young seeds, as they do not crop too closely. Sheep should be kept off until the pastures are at least three years old, and it is better to leave them longer under most circumstances. Nothing, however, does so much good to a pasture of four or five years or more as close folding with sheep fed on additional food to that grown on it. Grazing with cattle, by which the land becomes manured and the plants are induced to keep close to the ground, is the best method of treating young grasses during the first few years. Any feeding stuffs given during this time will be well repaid by the increase of grass and meat. If hay is taken off, manure in proportion should be returned; manure of a mixed nature is best. Farmyard manure is especially good, as the decaying straw

80 *The Conversion of Arable Land*

helps to make that fine vegetable mould that is so necessary about the roots, and induces worms to work, a most important feature in the making of a pasture. Lime is highly beneficial, as it induces the clovers to grow. Nitrate of soda has a marked effect on the grasses, though this is at the expense of the clover. Bone meal is a good all-round manure, influencing both the grasses and clovers. Kainit is beneficial in the same way as clover. Superphosphate, added to other manures, does much good where land requires phosphates. Sulphate of ammonia is beneficial to the grasses, and is less injurious to clovers than is nitrate of soda.

CHAPTER V.

TEMPORARY LEYS.

It is a significant fact that those districts in which temporary leys of some years' duration prevail are among the most prosperous at the present time, while those where the shortest are followed fare the worst—generally in the eastern counties. This is almost tantamount to saying that those who went ahead most in matters agricultural are suffering the most. It is an unpleasant reflection that the greatest skill and energy should meet with such a reward, but undoubtedly those who—properly, whilst corn-growing was most remunerative—kept their land at high

82 *The Conversion of Arable Land*

pressure, are those who are worst placed now. The man who took things more easily, and neither laid out so much money nor required so much skill and knowledge in his work, fares best. Climate undoubtedly had much to do with the matter. Where it was wet, corn did not ripen so well, and less was risked in corn-growing. If corn is not grown frequently, the land must lie in grass longer, for there is no profitable rotation to follow. In the dry climate and lighter soils of the eastern counties, long leys do not answer so well as they do in the moister climates of the west and north. Soil and climate have not altered, so these will have some influence on the length of time a pasture can be profitably left down now. In Ireland, in districts where it cannot be said that

the knowledge of agricultural matters is great, the low price of corn has not told so severely as it has in England, where there is a much greater knowledge. Contrary to the general impression, Irish agriculture, on the whole, is prosperous, and this is due to the length of time to which pastures are left down. In parts of Ireland where the knowledge of farming is greater, and where more energy is devoted to the working of the farm, the long leys are also the main source of prosperity. Where grass seed is grown for exportation it is still greater. On these farms the outlay is exceedingly small, the labour bill and the expenditure on implements being phenomenally little. Carts, implements, and tools together are worth but a few shillings per acre; and more are not really needed, as the work

84 *The Conversion of Arable Land*

is done satisfactorily with these. It may be taken generally that, where long leys prevail, agriculture is comparatively prosperous. The natural inference is that more should follow on these lines, and there is no better advice than that this should be done.

But the whole thing cannot be undertaken at once. If land is to be set to grow grass, there must be something to eat it. Where are these animals to come from? The grass is not wanted for hay, as the supply is sufficient already. What is to eat it? Already there is more grass than can be consumed by the stock in the country. If, say, two million acres were turned to grass temporarily, one of the first effects would be to raise the prices of store cattle, for the mere fact of turning land to grass will not cause cattle to come

to eat it. Simultaneously, or before the land is laid down, stock must be raised to eat it. Farmers must bear this in mind before launching out too far. There are only 25,000,000 sheep in the country now—there were 30,000,000 in 1878, notwithstanding the effect of foot-and-mouth disease during several preceding years; cattle have increased, but not to the extent which the extra pasture and the large importation of feeding stuffs warrant. Our advice, therefore, is to change, but to change gradually. The alterations in systems of farming must chiefly affect those who, up to the present, have not adopted long temporary leys. The rotations which provide for one grass crop in four or five years are those which require the greatest alteration. The four-course system admits

but one grass or seed crop in one year ; the extension of the period that the seeds should hold the ground for two years at once makes it a five-course system, and this, under the name of the Berwick rotation, is common in Scotland. This rotation may be regarded as a sound one, as with four cultivations, two corn crops and three green crops are produced. It is one that is suitable for very general adoption.

Except, however, where great care is exercised in selecting seeds, leys do not hold well in the dryer districts on thin soils for more than one year, and provision should be made to meet them. In Scotland, where moisture is fairly constant, rye-grass is a more valuable crop than in the drought districts of the south of England. In Scotland it is

regarded as a fairly good preparation for a crop; in dry districts it is not. On soils where the rye-grasses do not hold well, more responsibility is thrown on the clovers, and to ensure better results a larger proportion of cow-grass and alsike should be sown, as they make a good show in the second year. It is probable that on these hot soils it would be found better to go in for more frequent seedings rather than attempt long leys. Instead of the rotation mentioned, it is certain that more would be grown if it were changed as follows:—Wheat or barley-grass seeds (chiefly Italian and perennial rye-grass), barley or oats, clovers, roots. This necessitates two seedings, but the return more than counterbalances the extra cost; clover would come once in five years, and this

88 *The Conversion of Arable Land*

would be too frequent to take red clover or cow-grass. So each five years it should be alternated with red clover, and either white clover or alsike. In this way the danger from clover sickness would be avoided. The same principle would be adopted under other existing rotations where experience shows that leys of more than one year cannot be relied upon: it merely means the insertion of another seed crop at any convenient period, and the working of the farm is upset only to a very small extent. Where the climate and soil permit longer leys they are, of course, more advantageous, the chief drawback being that the greater length of time they are down the fouler the land becomes, as small pieces of couch grow into larger patches, which, if very bad,

require a great amount of work to destroy them. Long leys also encourage insect pests. Leys afford great harbourage to insects, such as wireworms, and several kinds of moths; the latter lay their eggs upon the foliage, and where they hatch the grub attacks the crop. These, however, do not seriously affect the value of leys.

In moister climates longer leys become more appropriate, and for some years show a profitable return. In some parts of Ireland we have seen good leys at five years, although the mixtures sown have included nothing more than rye-grass and red and white clover. Such leys, however, have been on good limestone soils, where the white clover has established itself thoroughly, and has appeared to have become permanently

90 *The Conversion of Arable Land*

fixed. So well have some of the leys done, that at the end of five years it looked almost a pity to break them up, for, owing to the great clover growth, they had become better established than many we have seen in less favourable circumstances at ten or twelve years. Conditions, however, are not so favourable as a rule, and the difficulty of making the ley stand has to be met by seeding with grasses which are of a more perennial nature than those employed in one year's ley. Timothy and Cock's-foot are the most suitable, as they take a strong hold on the ground, and produce big crops. The seeding must also be thicker. In the case of a three years' ley, fox-tail and hard fescue may be added where the land is in good condition. Yellow trefoil helps to fill in

the bottom in the first season, and answers well. In longer leys mixtures of strong growing grasses and clovers must be employed, but these will rarely do much good after the third year, unless they are treated liberally with manure. Where long leys are intended, the land must not be exhausted too much by cuttings, but they must be fed off by stock.

Lucerne and sainfoin allow of special opportunities for making long leys, as where soil is favourable they possess the property of holding the land for a number of years. A proportion of these should be sown in all pastures intended for long leys. They prove of greatest value, however, when employed separately. Lucerne does not do particularly well in mixtures intended for

long leys, as it is liable to be crowded out by other grasses. Some little surface stirring also seems to be beneficial to it. It requires to be considered as a crop for arable land, for then it does best. For this reason it should be drilled in rows a foot or more apart, and be kept free from weeds by hoeing, especially early in the year, for when once well up it is able, through its robust growth, to smother the weeds.

One of the present features of the seed trade is the extension of the quantity of the lucerne seed grown. Even in counties where it has not hitherto been grown, except on a very small scale, it is being sown freely. A great point in its favour is the power it possesses of withstanding drought. This is due to its deep rooting, and its success is largely

owing to the nature of the sub-soil in which, to a great extent, it feeds. The fen soils appear as unlikely as any for its prosperity, as it is little dependent on the organic matter in the soil, but if the peat overlies clay, or, better still, a rice loose sub-soil not far from the surface, it does well. Any open sub-soil containing a quantity of lime, whether in the form of chalk or limestone, is suitable, and the plant will establish itself. It becomes a matter for manuring subsequently, and this should not be spared, as the plant is able to give an enormous return, because it produces several crops in a favourable season. We know a field which has averaged three crops yearly for twenty years, and has received nothing but farmyard manure. On soils weak in lime or potash these should

be applied. Hitherto it has been considered as essentially a crop of the chalk soils, but it has been shown to be well adapted for a much greater variety, and it would be highly advantageous for it to be more frequently grown. A bushel of the seed shelled from its peculiar pod weighs 64 lbs. Drilled in March or April at the rate of 10 lbs., or sown broadcast up to 16 lbs. per acre, it soon gets a strong hold, and will make good growth by autumn. It should be kept down from five to seven years, but if smothered out by weeds, or if the soil is unsuited to it, it will give out before.

Sainfoin is especially suitable for chalky soils, and does fairly well in most others when the soil is not too wet or heavy. The amount of lime present largely influences its durability. In

Hampshire and the adjoining Down districts it is reckoned that land which has not carried sainfoin for twenty years should remain profitable under sainfoin for seven years. Much of the land, however, has been cropped with it frequently, and the length of a ley is more often only four or five years. In the eastern counties it is rarely left more than two years, sometimes only one. As it does not come to its best before the second year, it seems injudicious to destroy it so young. Sainfoin grows well when sown broadcast, and differs from lucerne in that it does not suffer from the presence of other plants near it, and does not require hoeing; it can therefore be sown in a corn crop, as it usually is. It is, in fact, most often sown with grass seeds, especially rye-

grass, so that in the first season, when the sainfoin will not give a full cut, a good sward is obtained. As the sainfoin gets more firmly established, the grasses gradually weaken. It is not an uncommon practice to mix a little trefoil with the seed to help to make a full plant in the first year. Although there is not much feeding value in trefoil it does good by sheltering the soil from the sun. It is best to mow sainfoin the first season, after which grazing is more advantageous. However, it makes such excellent hay for sheep that in sheep districts it is sure to be mown fairly frequently. Manuring and top-dressing aid very much in keeping it in a growing and healthy condition, and in this way its profitable duration may be much extended. It is, of course, necessary to

sow a crop like this, which is to be down for a number of years, on clean soil. It is usual to sow four bushels of unmilled seed (in the pod) or 20 lbs. of milled seed to the acre.

Seeds, when composed entirely of clover, are usually left down only one year, having been sown in a corn crop in the spring of the year preceding. One important reason for not leaving clovers down longer is that it induces the land to clover-sickness, and the clover plant is more liable to fail on the next occasion when it is sown. Broad clover is most affected by clover-sickness, and white clover often grows well under conditions which, from the presence of the eel-worm, would be fatal to the red. Broad or red clover gives a splendid return, whether in the form of hay or as green

fodder. Its peculiar adaptability to grow among grass seeds is a point highly in its favour for mixing with seeds for temporary leys. As a rule, from 12 to 16 lbs. are sown per acre, when no other seeds are sown with it. The amount of seed depends very much on the quality used. We had a good illustration of this in 1895. The seed bought in the case referred to weighed over 70 lbs. per bushel, and only 8 lbs. per acre were drilled; the plants were as thick and strong as could be desired, although there were over 40 acres sown in three fields possessing very different types of soil.

White clover, though unsuited for hay, is very valuable sown alone or in mixtures; it is rarely of much value when sown alone after the first year,

Those who produce fat lambs find it unequalled for laying on meat. It is, however, rather dangerous at times, as it has a tendency to "blow" the animals. To avoid this danger the sheep should not be turned into it when they are in a hungry condition, otherwise they eat ravenously, and it ferments instead of digesting. Clovers should not be fed when they are stale. Clovers become stale when fed by sheep, the manuring appearing to make them rank and unhealthy; if, however, a crop is mown off, the injurious tendency is avoided, therefore as far as possible grazing should be alternated with mowing.

CHAPTER VI.

LAYING DOWN LAND TO TEMPORARY PASTURE.

THE seeding of temporary leys is spring work. If there is any circumstance which makes it better to lay down permanent pasture without a corn crop, it does not apply to short leys. Short leys are crops of the immediate future. Permanent leys relate to the more indefinite future. As the profit is to be looked for in the first years of the ley, it is important to get the young plant thoroughly established in the year it is sown, so that in the next year it may

give a full return. Seeds sown in the autumn rarely do this, and the earlier the seeds are established in the spring the better, as they come on earlier and stronger the next season. The corn crop must not be entirely sacrificed to the seeds. Wheat suffers little at harvest when the seeds are well grown, but a big growth of seeds in barley proves vexatious, as long after the barley has matured and is fit for the stack, the green stuff at the butts remains green, and often holds a considerable amount of water. On very weedy land, particularly on that much infested by annual weeds, it is often desirable to hoe the barley before the seeds are sown. In some districts the seeds are sown immediately before hoeing, and are hoed in during the operation of destroying the

weeds, and this is a good plan under the special circumstances. In a wet spring there is little trouble in getting the seeds to grow, but it is a far more difficult matter to get a plant in a dry spring. Seeds sown broadcast in such seasons lie dormant a long time, or perhaps germination is set up by the little moisture turned up by the harrows, but for want of continued moisture the young shoots die off, and the seed is worthless. The best method for securing plants in persistently dry seasons is to horse-hoe between the corn-rows, and immediately—not in a few hours, but at once—follow this with the seed drill set so that the seed falls in the moist track made by the hoe, and then roll it in. The seed thus lies in the moisture, and as the land is rolled, the moisture is

prevented from escaping freely, but keeps consistent through the supply brought up by the capillarity of the soil. The little track lies in a shallow furrow, so that in event of the light showers falling, the wet is conducted to it. Where possible, however, the seed is best sown broadcast, as the plants are then better distributed about the ground, and it is less expensive.

The preparations for seeding a temporary ley are necessarily very simple, and as a rule amount to little more than procuring a fine surface; in fact, it is generally sufficient to sow the seeds on the surface, merely harrowing them in. When sown in winter-wheat the seed can rarely be buried too deeply by ordinary seed harrows, but in spring-sown corn great care must be taken. If

the surface lies in large, loose clods, it is very easy for the seed to fall to a depth which will prevent it germinating. The surface must be brought down to a fine condition, and it may then be necessary to tighten it with a roller. The corn crop must not be sacrificed by the land being made to "cap" through injudicious harrowing, or rolling when it is in a wet condition. The harrowing or rolling, or, for that matter, the abstinence from both, if circumstances demand it, are subjects for determination in the field. The heavy soils which are among those where it is most important to stay the plough, are very liable to "cap," and the aim of the farmer must be to lightly cover the seed with soil, but not to do it in such a way as to render the land liable to be injured by drought subsequently.

There is no absolute rule as to harrowing or rolling, and it must always be a matter of discretion settled in the field. It is, however, important to urge carefulness, for often, even when there are no seeds sown, a well-worked and good corn seed-bed is ruined at the time of sowing the corn, by want of judgment in ordering the last operations. When the weather is fair anyone can sail a boat; it is the catchy weather that proves the sailor's skill; so it is in farming; there are plenty of fair-weather farmers, but the foul-weather farmers are not so common. In genial weather nothing is more simple than the process of sowing grass seeds.

Except in market-garden districts there are few men who can sow small seeds with any degree of evenness, but

seed distributors, which sow with all needful accuracy, are not difficult to get. The ordinary seed-barrow answers most purposes, although where there is great variation in the size of the seed it is necessary to sow it in more than one operation, otherwise the small seeds are run out as soon as the box is filled, and the large ones left to be sown subsequently. This, of course, prevents anything like even distribution, and must be guarded against by going over the ground twice, or more, if necessary, according to the varying size of the seeds. When this is done it is advisable to cross the drafts, so that, if there has been any irregularity in the steering of the barrow, the gaps will be filled in. Windy days should not be chosen to sow small light seeds. The machine for which Messrs. Cotton

recently obtained the Royal Agricultural Society's silver medal, combining a roller and a seeding machine, is a useful addition to the machinery of the farm.

As a rule, mixtures for temporary leys need not be very complex. The great aim should be to grow as many leguminous plants as the land will carry, without making it clover-sick, and therefore unable to produce clovers in the next rotation. Long leys of clover tend to make the land clover-sick, because the lime and potash in an available form as food for clovers become exhausted, and on many soils it takes a long time for them to accumulate in sufficient quantity to support another crop. When the supply is short the young clover plant loses vigour, and is attacked by the stem eel-worm, which soon destroys it. The

advantage of growing clovers and other leguminous plants is that they possess the power of taking from the atmosphere nitrogen, which grass is unable to assimilate therefrom. The nitrogen thus acquired is as valuable as that for which a high price is paid when purchasing nitrate of soda, sulphate of ammonia, and other nitrogenous manures. The plant is enriched by it, and some portion goes into the hay, while the other is stored in the roots, which, when they decay, give it up to the soil. The value of a good clover stump or root is recognized everywhere on account of its manurial effects; consequently, it is easy to understand how important it is to grow clovers and to do all that is reasonable to encourage them. The varieties of clover which are to be sown should be regulated to some

extent by the purpose to which the leys are to be put. If grazing is the chief object in view, more clover should be sown, as that affords excellent sheep pasturage. Where hay is required, a greater quantity of broad clover and cow-grass are wanted. These should always be in good quantity, except when there is reason to believe that the land is specially liable to clover-sickness. When this is the case, white clover and alsike should be sown more freely. Of the other important leguminous plants, lucerne and sainfoin, an account of the circumstances under which they thrive, and may be used profitably, has already been given. Although the inferior clovers and leguminous plants, such as trefoil, bird's-foot trefoil, and yellow suckling, do not give a good return, there are circumstances in which

they may be profitably sown in small quantities, and, as a rule, a sprinkling of each in mixtures for leys on light, poor land, where the better clovers do not grow freely, is not out of place. The cost of the seed is small, and they help to make a sole to the turf, and do not injure the hay. Where clover is grown in considerable quantity, it is important to see that it is free from dodder, as that parasitic pest spreads with great rapidity, destroying all that comes in its way, and, if left to seed, renders the soil unsafe to carry clover for some years, as the seeds lie dormant for a long time. Careful sifting is the only safe way of insuring against it. If it appears, the patches should be carefully and thoroughly destroyed by burning.

The most simple seeding for short leys

is a mixture of rye-grass and clover. A bushel of rye-grass and 8 lbs. of red clover is a common seeding where clovers thrive better than rye-grass. Where rye-grass thrives better than clovers, two bushels of rye-grass and from 4 to 6 lbs. of red and white clover is found a good mixture. This is a full seeding of its kind. Rather less of either may be sown; in fact, it is found that in the place of a 50-lbs. mixture 40 lbs. is usually enough. Where a more general mixture is sown, including some of the smaller seeded strong-growing plants, like timothy, the quantity may be reduced very materially, and from 30 to 35 lbs. of seeds are sufficient. It is, of course, important to use grasses of high germinating powers and of good stock. By dint of careful selection our great

seed firms have done much to improve the quality and yielding powers of the important grasses, and the improvement in these grasses is, perhaps, more advantageously felt when they are used for temporary leys than when used for permanent pastures. This is only natural, as the grasses undergo little change in the short time they are down. If they are not of good type, the soil has a poor chance of influencing them. Grasses grown in particular climates, or on particular soils, have more or less distinctive features, though, perhaps, this is not so noticeable as in the case of clovers. American red clover seed is not nearly so large as well-grown English, nor will it produce anything like the same growth. It is, in fact, a dwarf variety of English clover. On

occasions when the quantity of home-grown seeds has run out, we have bought small lots of American to finish the field, and then the difference has been most marked, for it has never at any cutting given so great a yield. Low-priced clover seed is rarely cheap, because it is priced low for one of the following reasons:—Inferior stock, presence of weeds, weakness of germinating power. The best means of guarding against a weak stock, particularly in the case of red clover, is to buy bold, well-coloured seed. The presence of the seeds of dock, plantain, and other plants materially affects the value of a sample of red clover; small seeds of dock and plantain also are found in white clover and alsike, and in addition to these are those of sorrel, forget-me-not, and others, which,

from their size and weight, are very difficult to take from the sample. The most frequent weed-seed found in white clover, however, is that of the wild geranium. We have seen samples containing fifty per cent of this adulterant. It is somewhat difficult to detect when only casually looked for, as it is about the same size, colour, and shape; more closely observed it is seen to be of rather darker colour, approaching chestnut, and to be more rounded and plumper instead of heart-shaped. Under a magnifying glass it is easy to detect. So careless, however, are some buyers, that I know of markets where large quantities are sold where not one buyer in twenty could tell what it is, or has even noticed its presence, although in those same markets scarcely a sample is

sold with less than ten per cent. present, and far larger quantities are common.

Red clover should be bold and well tinged with purple; brown seeds are dead; yellow are often of weak germinating power. White clover should be a pale golden yellow; when brown and withered they are useless. Alsike should be a dark green; when light green the germination is weak; brown are dead.

When buying grass seeds from firms of good repute there is little fear on the point of adulteration. Low-priced articles have a fascination for many people; the consequence is they buy in the lowest and dearest market, and sow what they have no wish to reap. It is impossible in a short space to speak of the adulteration of all grasses, and so

describe them, especially without the aid of illustrations, in a way that would make them recognizable. Our best advice is for those about to buy grasses to obtain a sample of each one, and under the magnifying glass (one at a shilling is quite powerful enough) learn to know what its features are. If there are two different seeds, it is obvious that one must be a stranger and has no right there. The trouble of learning to distinguish the seeds of the ordinary grasses sown is so very little that there is no excuse for a man not taking so simple a precaution against adulteration. If a man has not this knowledge, he should buy on guarantee and let someone else analyze for him. It is so very simple, however, that any one may soon become expert in detecting the presence

of foreign seeds or other matter. Seen under magnifying power, the several seeds are as easy to distinguish as oats from barley. The germination is a simple matter, but there is some little art in taking a fair sample ; this should be taken from the main heap, not from the sides where the lighter seeds naturally fall, but by inserting the hand well into the heap.

Farmers rarely possess machinery suitable for cleaning grass seeds as thoroughly as they should be cleaned. The modern winnowing-machine with wire-wove sieves is not equal to the old-fashioned Cooch winnower with perforated sieves. Small grass and clover seeds require a wind separation combined with sifting power. When first going over a famous seed-store we

were much struck to see so many of the Cooch winnowers at work among the special machinery. For ordinary purposes machines of this type, fitted with sieves of suitable size, will clean clover and most of the ordinary grasses.

CHAPTER VII.

MANAGEMENT OF TEMPORARY PASTURES.

PERMANENT pastures depend for their success in no small degree on the treatment to which they are subjected during the time they are acquiring their permanent characteristics. The aim in this case is to establish a plant which will stand for an indefinite period. Temporary pastures, of course, are of shorter duration, and there is, naturally, less chance of treating them improperly. At the same time there are right and wrong methods of treatment, which influence their value. When grasses are sown

down in a corn crop there is little to be done until autumn ; docks and thistles may be drawn or cut up, but beyond this they must be left until the corn crop is harvested. The hoe or spud should not be used for cutting up weeds, as the young seeds are destroyed in the operation. A docking-iron for the docks, if they will not draw by hand, and a weed-hook for thistles, are all that are permissible. Where seeded without any other crop an opportunity is afforded to keep in check, by means of the scythe, other weeds which would prove injurious ; however, it is the annual weeds which make most show, and so far as the temporary leys are concerned, they do not often do serious injury ; when, however, they are allowed to seed, they prove troublesome in succeeding corn

crops, and this should be prevented. Cutting with a scythe, or a slight brush with a mowing machine, set high so as to miss most of the grass, is usually sufficient. Charlock is the worst weed in most districts, and it is very important that it be not allowed to seed. In early-sown seeds it comes to maturity, but in autumn-sown grass it rarely produces seed, and is killed down by winter. Seeds afford a good opportunity for keeping this pest in check, and it should not be lost, even if the charlock has to be pulled.

Young seeds, according to the season at which they are sown and the amount of growth they make during the summer months, may, or may not, be fit to graze in the autumn. Except when the land is heavy and wet, good, rather than

harm, is done by grazing. The earth is trodden firmly up to the roots, causing the plants to become better established and less likely to be injured by frost. Many people object to autumn feeding, but so long as the animals do not tread the land so to leave saucer-like depressions, which hold the water during winter, the treading does good. It is advisable not to stock young grasses too hard, but light stocking does good rather than harm. Treading by sheep does far more good than is effected by rolling, as the roller works more unevenly, and a proportion of the plants are not affected; whereas sheep pinch in the earth about the roots of all plants.

Where there is much clover in the ley it is necessary to be careful, when the plant is fresh and growing, that the

sheep feeding it do not become hoven or blown. Injury from this cause is more prevalent in spring than in autumn, but occasionally it occurs in the latter season. If sheep become blown, which is indicated by their distended sides, particularly the left side, they should be at once removed; and it is advisable to keep them moving for some little time, so that the gases which have generated may work off. If an animal has become very bad, and there is fear of its bursting, its stomach should be punctured by a trocar, but as this is not often available, a long knife may be used. Frothing at the mouth is a preliminary symptom of hoven. Where the leys consist mainly of grasses there is little to fear from hoven.

Little can be done in the way of

keeping the land clean after the first year beyond destroying docks and thistles, unless patches of couch are dug out in the autumn. A few years ago the autumn forking of the leys to take out the couch patches and docks was a common practice on almost all well-managed farms. Where land is carefully worked and kept clean by skilful tillage and hoeing, the digging out of small patches of couch which may have eluded other implements, is a profitable operation, as it renders unnecessary extra cleaning after the ley is broken up. Where the forking out can be done for a shilling or two an acre, it is well worth doing, but of course where a field is smothered by innumerable patches, the expense of digging is so great that it is better to leave the cleaning to be done

during the fallowing operations connected with the root crop. It is, of course, useless in those instances where quantities of couch seed is sown among the seeds purchased. As before stated, carelessly-purchased seeds contain more impurities, such as seeds of couch, which may often pass notice because the buyer does not know one seed from another. In the first year the young patches of couch are not bigger than can be dug out with a fork at one dig ; but in the following year, if left untouched, they are two or three feet in diameter, and increase proportionately in subsequent years until the field becomes so foul that, if for no other reason, it is necessary to break it up. This should impress buyers with the necessity for care in purchasing. It is strange that with couch going to seed

in every hedge-row and ditch side, a vast number of people who have farmed for half a lifetime cannot recognize it. It is scarcely to be wondered at that they buy inferior seeds, and in doing so make foul land. It is sad to think that many farmers who possess great skill in managing and cleaning land, undo the work of years by sowing grass seeds containing so much couch-seed, that by the time the ley-land is broken up, it is as foul again as ever.

Temporary pastures possess a remarkable property, namely, that both the grasses and clovers of which they are composed are able to add materially to the fertility of the land. As a rule, grass seeds are looked upon as being somewhat exhausting to the land, unless they are fed very frequently. They can, however, be

made to add greatly to its permanent fertility. Grasses are particularly partial to nitrogenous manures, especially to nitrate of soda. If nitrate of soda is applied, practically the whole of it is utilized by the crop, as it is not easily washed out of the land even by winter rains. The nitrate thus utilized becomes organic nitrogen, and when the crop is fed the farm is enriched by it. Clovers, as has long been recognized, add to the fertility of the farm and to the land on which they grow. The crop taken off the land enriches some other portion of the farm ; and the root or stump contains so much nitrogen that the land is richer after the crop than before it was grown. This was recognized, but it was not known why it produced this result until within recent years. Now, however, it

is known that nitrogen is taken from the atmosphere, and as it is proved that the amount of nitrogen acquired is largely dependent on the amount of potash and lime available, the value of applying these manures is understood.

Perhaps one of the most remarkable features in the changes which have come over farming within the past few years is the altered views which farmers, as a rule, hold as to the value of artificial manures. It was considered a sign of astuteness, even among otherwise smart farmers, to decry their use, and the man who had the best collection of terms, such as jumping powders, stimulants, &c., was considered the smartest. By understanding the properties, uses, and methods of applying them, their real value has been discovered, and now

comparatively few farmers fail to recognize their value as *bonâ fide* aids to fertility. As aids to grass and clover-growing they have proved highly valuable; for, though they lack the mechanical properties of farmyard manure, they supply what worn-out, or less used-up, soils require to make them grow remunerative crops. No single manure is so beneficial to pastures as farmyard manure, and there is no part of the farm where we like to see it applied better than to the pastures; but it is expensive to make when the best stall-fed beasts fetch only 4s. per stone; and a good coating of it runs into a large sum per acre. A dressing of one hundred-weight of nitrate of soda, three hundred-weights of superphosphate of lime, and three hundred-weights of

kainit, which can be applied for 16s. an acre, is a good full dressing to apply to a temporary pasture in the second year of its ley, when the first fertility set free by the tillage has been, to a great extent, exhausted; and it is at any time a liberal dressing for old pasture. Three loads of farmyard manure cost as much, and will not give nearly so good a return. As already stated, the produce raised by the artificial manure when consumed takes the form of organic manure, and, if fed on the farm, adds to its lasting fertility. Unless the crop is made into hay and sent off the farm, instead of the land becoming exhausted, the fertility is increased by the use of artificial manures. The constant use of nitrate of soda with no other help tends to exhaust the land of the constituents

supplied by mineral manures, and, if persisted in for a long period, fails to realize as good a return as it should; it is most marked if the grass is mown and taken away. It acts less injuriously if the grass is constantly fed; in fact, if the land is rich in the mineral constituents, it may be used with great advantage for a practically unlimited time, provided the land is grazed. In temporary pastures kept down for two or three years only, exhaustion is not so noticeable, especially if a root crop is grown during the rotation, and it is fed on the land where it grew.

On short leys quickly-acting manures give the best results; on permanent pastures slower acting manures, such as bones, farmyard manure, and any decaying vegetable matter, have a good effect,

but pasture-making without grazing is not a satisfactory process. If the crop is taken off every time it grows, a large return in the way of manure must be made. The beneficial effects of grazing and treading are also most marked, and tend to produce a close soil or sod which cannot be got when land is always under the scythe. The close sod, and general mixing of herbage, is not so essential in temporary leys, and greater latitude in the use of the scythe is permissible, provided the fertility exhausted in taking away the crop is made good by returning the equivalent in the form of manure.

Where clovers preponderate in a mixture, mineral manures should be used to increase their growth, and so as to increase the growth of the grasses

with as little hindrance to the clovers as possible, it is better to substitute sulphate of ammonia for nitrate of soda, it being found that clovers thrive on sulphate of ammonia. In fact, almost all sulphates appear to act beneficially on clover, and sulphate of lime is sometimes found to give exceptionally good results. On moory and sour land basic-cinder proves of great value, and on heavy land generally does well. On light gravel soils it is uncertain, and in some experiments we carried out for several years on light gravel land, dressing varying from 500 to 2000 lbs. per acre made practically no difference to the yield. Where mixed with other manures it did better, but never more than moderately. Malt culms, soot, almost any manure, in fact, do good to grasses.

Mineral manures should be applied in autumn or winter; the beneficial effect of these manures is often lost for nearly a year, through their being sown late in the spring. They require to be washed into the soil early, otherwise they begin to work too late to do good in the year in which they are sown. If sown in March, and the weather remains dry through April and May, they do not become incorporated with soil sufficiently early.

Farmyard manure should be applied at different times according to circumstances. As a rule, long dung should be applied in autumn and early winter, and short dung in the spring; however, it is less important on grass land than on arable, as the roots prevent much loss which would occur were it applied

where no crop was growing. It may be taken as a broad principle that long dung protects the plant through winter, sets the worms working, wastes little from soluble portions being washed into the drains, and becomes fit to be taken up by the crop early in spring. Short dung may lose a portion of its soluble matter if applied in autumn, but is quickly available if applied at the end of winter; it works into the soil readily. As stated before, however, the loss of manurial constituents is not serious, and any convenient season may be availed of. In some districts it is the practice to dung immediately after the first crop of hay is off; on burning soils this is done with advantage, as the manure acts as a mulching, and the prejudicial effects of drought are averted. Leys and

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pastures are so benefited by manuring that it is commonly said that any kind of manure does good, no matter when applied. This is more correct than many sayings.

CHAPTER VIII.

UTILIZATION OF THE CROP.

PASTURES or leys afford food all the year round, for though there are times when little can be grazed, hay and ensilage may be made to supply the animals during such periods. As rotations are increased in length by the addition of longer leys, the root crop becomes curtailed, and this alone makes an alteration in the system of farming. Stock, especially sheep, are diverted from the turnip fold to the pastures, and where it has been the custom to rely on roots for food for sheep in autumn they have to be kept longer on grass. There is nothing to object to in this, as it is

cheaper to feed off pastures than to cut turnips. One naturally looks to sheep as the best means of feeding short leys, because fields which have been turned from arable to grass are rarely well enough fenced to hold bullocks, and sheep are better distributors of manure than cattle. On permanent pastures the heavy droppings of cattle affect the whole field in course of time, but on short leys they are patchy, and consequently the manuring is not so effective. At the same time temporary leys produce a large amount of excellent food, and are well adapted to carry young stock.

It is necessary, where leys are required to be fed while green, that they should not be allowed to become stale or soured by too constant manuring. When sheep feed off leys too frequently

the growth is strong and apparently healthy, but the animals are liable to scour, while lambs and young sheep are apt to "go wrong." Every sheep-keeper knows what this means, and how difficult it is to get them round unless there is a plentiful supply of fresh food to turn them on, so too much care cannot be exercised. For some years, whilst conducting the experiments at Woburn for the Royal Agricultural Society, I had to weigh the sheep frequently, and it was a significant fact that they always did far better the first time over than in subsequent feedings, though, to all appearances, the food was as good at one time as at another. In the case of the white clover leys the sheep always did as well without any extra food in the first feeding as they did with it. The

clover apparently supplied all that they required in order to lay on as much flesh as they were able. In the second feeding, however, there was always a wide gap between those which received cake and those which received nothing but clover. There is no reason to suppose that the clover possessed less feeding matter, but it was not so palatable or digestible, consequently the cake was required to correct the deficiency. As this occurred every year for several seasons, it could hardly have been accident. It may safely be taken that where clovers predominate in a ley there is great risk of souring, but there is less danger of it if the quantity of grass increases. On old pastures, probably owing to the greater amount of grass and the effect of the large accumulation

of humus, the danger of injury from souring is very greatly lessened.

Where sheep-farming is largely carried out it is particularly necessary to avoid souring. This is always effectively done where mowing is made to intervene between the grazings. If it is not desired to make hay, there are two alternatives; the crop may be cut green, and so used for soiling cattle and horses in the yards, or it may be made into ensilage. In soiling, the cost of mowing and carting to the animals have to be set against the increased amount of food obtained by preventing loss by treading into the ground. This is very considerable in wet weather, and through the better thriving of the animals (particularly in very hot weather, when, through the discomfort of heat and the

annoyance of flies, they rest badly) it may be taken that the cost of getting the stuff to the animals is met by the increased amount of meat laid on. Beyond this, valuable manure is made, and may be used with full advantage. When grazing in hot weather cattle make bad distributors of dung, as they collect under trees and in other sheltered spots where their dung does little good.

Ensilage is particularly valuable when the root crop is lessened on account of diminished acreage. We do not recommend expensive systems of silage, as the drawn-up heap is effective and calls for no outlay beyond labour. As food for ewes we know nothing better, and nothing which ensures a better flow of milk. Sheep take to it readily, particularly to that which is most heavily

compressed and most acid. The lambs do well on the milk which is produced by their mothers when fed on ensilage. In winter, when roots are cold, especially when they are frozen and indigestible and often difficult to get, ensilage is especially valuable, as it is warmer. Cold roots lower the temperature of the animals eating them, and a large proportion of the food contained in them has to be devoted to sustaining the animal heat. Ensilage cut fresh from the heap is comparatively warm. With hay, ensilage, and the pastures themselves, sheep can be kept at small expense, and there is no need to go to the root heap.

Hay-making should be commenced when the grasses are still young. The quality of the hay is greatly improved, and, though there is not the bulk of hay,

it is well counterbalanced by the greater growth of aftermath. Hay made from leys requires more careful handling than that from permanent pastures, as, owing to the larger quantity of clovers in it, the leaf is likely to be lost if knocked about. The tedding practised in grass hay-making is not permissible; it must be turned lightly by a rake or fork, without shaking or tossing. Instead of putting into windrows and running up into heaps for pitchings, it requires to be cocked in the same manner as corn.

Cattle are better adapted for grazing longer leys than shorter ones, because, if the fields are not already fenced, it is worth while to put down a temporary fence. The mixing of cattle and sheep when grazing is also advantageous. Cattle-grazing does not render the crop

sour to sheep. Sheep after sheep without an intervening mowing is bad, but sheep graze safely after cattle. The alternation is therefore beneficial. Where cattle are grazed and corn or cake is given them, the corn troughs should be moved frequently so as to attract the animals to different parts of the field in order that the manuring may be evenly effected. Sheep troughs should also be moved daily.

It is very un-English to graze pigs on clover, but it is one of the cheapest ways of keeping them. Pigs like grass, but have a special preference for clover. They will eat it either when cut and soiled to them, or they are perfectly happy when they do their own cutting. With shade and water they thrive well, and there is no better method of keeping

in-pig sows. The danger of slipping their young prematurely, which is experienced when sows are fed almost entirely on turnips, does not exist ; and the exercise they get in moving, even in a comparatively small fold, keeps them healthy ; in fact, there is no better way of insuring safe farrowing. Americans, who are skilled pig keepers, rely very much upon the clover patch for rearing and fattening their pigs. A few corn cobs and a supply of water are all they get in addition. No pork is made on cheaper lines.

Corn-growing England has not gone in for grass seed-growing to the extent it might. It has not accorded with the rotations in vogue, and the terms under which land has been rented precluded it. The greater freedom of cropping now

allowed has opened a wider field, which those favourably placed should not be slow to utilize. The climate in many parts of England is not suitable for the production of all kinds of grass seeds, but most varieties can be grown profitably in one or another district. The arable land of England, so long subjected to the influence of the hoe and good cultivation, is in a better condition to carry clean seeds than is much of that producing grass seeds. Rye-grass growing is carried out in Ireland on land which has never known a hoe, and the crops are often infested with alien plants. Yorkshire fog, couch, onion couch, and brome grasses form no small portion of the grass crop which is to produce seed in the districts in Ireland where rye-grass seed-growing is an important and pros-

perous business ; yet the Irish seed is put on the market cleaner than is that grown in France. On clean soils, in the fairly moist districts of England, the finest and cleanest rye-grass seed might be grown. The harvesting is very simple. The crop is cut, tied into sheaves, and left in the stock until fit to thresh. It may be threshed in the field, or be stacked and threshed at leisure. The seed falls out readily under the flail, and often little more is done beyond knocking the sheaf against a bar. The seed is hit with a stick held in one hand, while the sheaf is held in the other. The feeding matter of the hay left behind is not quite equal to what it is when the grass is cut young ; but, if chaffed, it is a valuable fodder for horses, cattle, and sheep. When in Ulster, a farmer showed me a

field, then in its second year, which looked like growing four or five cwt. of seed per acre, and twenty-five to thirty cwt. of hay. In the previous year he grew on this same land eight cwt. of seed, which he sold for 17s. per cwt., and thirty-five cwt. of hay, which he sold locally at 4s. per cwt., making in all 13l. 16s. per acre. This was not bad as things go nowadays. Those farmers who possess clean land, and a climate suitable for growing rye-grass seed, might do well by turning their attention to rye-grass seed-growing. It is an advantage that, when growing the seed, clover need not be entirely precluded from the mixture. The hay is improved by it, and if sown in moderate quantity does not materially affect the yield of rye-grass. Cocksfoot, timothy, and other

similar grasses may also be grown with good success. With the prospect of more land going to temporary pasture, the demand for seed is likely to increase rather than decrease. Even for home growth on the farm a small patch of carefully-selected seed is well worth growing. Clean seed can thus be insured, for by pulling out weeds and grasses other than those desired, there can be nothing to render it unclean. It is, of course, important to sow good seed in the first instance, and in small patches. For growing stocks artificial manures are preferable to farmyard manure, as the latter often contains hay seeds, which, on growing, at once make the stock untrue.

Clover-growing for seed purposes is rightly considered in conjunction with the disposal of the crop. In speaking of

clover seed it is usual to allude to it as maiden, or second-cut seed. The maiden is that which is produced from the spring growth; the crop being allowed to grow and ripen before being cut or fed off. This ripens in summer. Where a crop of hay or a grazing is taken and the second crop allowed to go to seed, it is called second-cut seed. This ripens in autumn, and as the weather is not reliable at that season it is often difficult to harvest. It frequently occurs that there is a very large acreage ploughed in as manure after lying wet so long as to be worthless for other purposes. As a rule, maiden seed is the best coloured and the finest, but is also most liable to contain seeds of weeds, as weeds such as plantain and dock ripen under ordinary conditions at the same time as clover. In the second

cut this is to a great extent avoided. Clover requires a sunny climate, as without it the growth of foliage is made at the expense of flowering. Crops of moderate size are better suited to produce a good yield of seed than are very heavy ones, because they flower more evenly, and the crop is less liable to be laid or storm-broken. Clover seed never ripens simultaneously throughout the crop, but usually at three periods. The top seed is generally light, the middle seed often is the best, and the last to ripen is too late to wait for. A considerable amount of discretion is required to decide when the crop shall be cut, as there is no definite rule as to which ripening is the best. The aim is naturally to catch all three ripenings, and this is most easy on a moderate crop in sunny weather, as

they then come nearly together. Clover requires very careful handling, as when dry the seeds fall out with the least blow. White clover is most difficult to get, as the best crops are grown on short stems, and unless the land is level it is sometimes impossible to cut off all the heads; and when the heads are cut it is difficult to gather them together. It is often necessary to collect them with a daisy-rake early in the morning whilst the dew is on the ground. To attempt it when the seed is dry would be useless, as it would all thresh out. When cut, the sward of any kind of clover should be made into small "horse-head" cocks, and these should be turned occasionally, increasing them as the material dries by putting one to another. Large cocks should not be made at any time,

for the pressure of sticking a fork into them would knock out a large quantity of seed. They should not be bigger than a long-tined fork will gather without pressure. The loads should be built so that no portion of the material is outside the body of the cart or waggon, as there would be considerable loss, particularly in the case of white clover. The crop must be absolutely dry at the time of stacking, so that heat is not generated, as heated seed is spoiled in colour, and, if badly heated, germination is destroyed. Fine weather should be chosen to thresh the seed, and it is generally advisable to wait until frost comes. The cob, or seed heads, which come down an ordinary threshing-machine where the chaff of corn falls, is the part to secure. If a clover-rubbing

machine is not working simultaneously with the threshing, the cob must be stored in a dry place, care being taken that it is not trodden upon or consolidated more than is absolutely necessary. A considerable amount of winnowing is required to clean the seed, though, from its lightness, it is necessary to winnow lightly. By saving one's own clover seed the risk of getting inferior foreign seed is avoided. As a rule, the districts best fitted for grass seed-growing are too moist for clover seed-growing, and *vice versâ*. This is, of course, not a hard and fast rule, and the two sometimes may be grown alongside, but wet districts cannot be relied upon for clover seed-growing, and dry districts are not favourable for the fullest crops of grass seed.

CHAPTER IX.

GENERAL PRINCIPLES ASSOCIATED WITH PERMANENT PASTURE-MAKING : IN- FERIOR GRASSES AND WEEDS.

It is more easy to realize the conditions under which permanent pastures thrive when the circumstances under which they were formed are borne in mind. No such thing as a permanent pasture existed at one period of the earth's history, for there was no vegetation of any kind; yet by the process of evolution, from low forms of plant life they have gradually come into existence without the aid of man. At the present

time we have in England exemplifications of pastures which have been formed with little outlay of labour on the part of man. Take the thin chalk downs which are covered with a permanent pasture, poor, it is true, still permanent. The same on heaths. Many of our richest pastures are undoubtedly self-made, except that the land was probably cleared of its forests. We see around us to-day pastures in course of development. Land which was cultivated a quarter of a century ago fell out of cultivation and was allowed to take its own course. Couch grass and other weeds held the ground, but where the land had a reserve of fertility these are gradually, in most cases slowly, giving way to more nutritive grasses and other herbage, accumulating plant food year by year,

and thus forming the early stages of permanent pasture. The rapidity with which these become capable of carrying sufficient stock to show an appreciable return depends on the nature of the soil with regard to its texture and the amount of food contained in it, its freedom from stagnant water, and the assistance rendered by manuring, or the feeding of extra food upon the ground.

A good example of the change from barrenness to a higher state of fertility is shown in the case of a tiled roof. New tiles present a perfectly clean surface free from vegetation, yet in course of many years we find them grass-grown. In the first instance some minute plant of low order, it may be of a fungus type, begins to grow, and this goes on almost imperceptibly for

years, but gradually it thickens. Why? Because generations of the tiny growth have died down and left their remains to supply food for successive generations. In course of time the roof becomes covered with a deep covering of moss, and after this grasses of poor quality are found intermixed with it, and if left long enough the decay of the plants produces a thin soil, capable of producing grasses of better quality. This roughly indicates what has taken place in nature, and illustrates how, as the soil is formed or improved, higher forms of vegetation are carried.

The capability of soils in a particular condition to carry certain grasses is well exemplified in the experiments on old pastures at Rothamsted. A few acres of such were set apart for experiments, and

each plot has been manured with a dressing containing more or less of the several constituents of plant food. Although the pasture through the whole of the plots experimented upon was nearly as similar as possible at the time the experiments commenced, they differ now in a marvellous degree both in appearance and in the varieties of grasses which compose them. Some are luxuriant and carry herbage of highest feeding values, others appear poverty-stricken and none but inferior grasses can be found, while others produce heavy crops of coarse and profitless grasses. Permanent pasture of the best feeding value is not, however, entirely composed of grasses; leguminous plants and other miscellaneous herbage, in fact, often form its most important feature.

They, moreover, perform an important part in the formation of new pastures.

This brings us to a question which may naturally arise. Why is one pasture field better than another? It is richer in fertility, the soil is healthier in the matter of drainage, the pasture is older and therefore more self-supporting. To lay down a field which is what is known as worn out with regard to fertility, and not to supply manure to it, is to invite failure. This is most marked on heavy soils where the mechanical conditions are also unfavourable. The land is not in a condition to supply food for a heavy crop of nutritious plants, and it is impossible for it to carry them. It can only produce a light crop of grass, or under some conditions a larger crop of grasses of poor quality. Land in poor

condition will sometimes produce a heavy growth of poor grasses such as Yorkshire fog, the feeding value of which is small, as nearly the whole of such a plant is indigestible woody fibre, which has about as much feeding matter as saw-dust. The mechanical condition of a heavy soil is altered when it is covered with a thick pasture, and this accounts for good rich pastures such as are found on heavy land. The thick mass of fibre prevents the land from cracking in time of drought, and the surface water drains through it more easily. In the case of a previously almost purely inorganic soil there is a considerable accumulation of vegetable matter to supply the pasture with food it cannot find on land newly laid down,

INFERIOR GRASSES AND WEEDS.

Although it has been pointed out that in course of time the varieties of grasses found in a pasture are those which find the conditions of soil and climate most suitable to their growth, it is obviously absurd to sow seeds of worthless or inferior grasses, as they produce little that is of value, and take the place of more valuable varieties. Some years would be occupied while the better varieties were obtaining mastery over the inferior ones. The sowing of inferior varieties is therefore as unwise as unprofitable. Among the inferior grasses may be included the whole family of Bromes.

The soft brome (*Bromus mollis*) is most commonly found in pastures. It is also

frequently found in fields of rye-grass and other grasses from which seed is taken. The seed is thus mixed with the better kinds, and, unless carefully screened, is sown with it. Those who are acquainted with rye-grass seed need have little difficulty in detecting its presence. All brome-grass seeds are coarse. Soft brome is larger than rye-grass, being longer and much wider. The hard, flat kernel seems to lie deep in the sheath of husk. The seed is narrow at both ends, but bulges widely at about two-thirds its length, and contracts somewhat suddenly at the top. The kernel, as seen when slightly magnified, is covered by a thin husk, which has serrated edges. The edges of the large sheath-like portion of the husk are serrated also. The piece of stem attaching to the base is short, somewhat thick, and

slightly hairy. A definite keel runs down the back, and is continued so as to form a stout awn; when viewed from the back the seed is suggestive in shape of a small boat, as ribs run from end to end. The whole of the back is hairy, but the hairs are stronger at the top than at the bottom. Other brome-grasses are coarse, and the seeds are easily distinguishable from those of the grasses the farmer is likely to want to grow.

Yorkshire fog (*Holcus lanatus*) is one of the commonest grasses in permanent pastures. It is found very commonly in hay-lofts, and those who prefer to sow seeds from this source to buying them should be careful to examine closely for these. The seed is small, and might be taken for that of one of the finer grasses. Brome-grass seeds are also common in

the sweeping of hay lofts, but they are more readily noticeable. Both germinate freely and strongly, so that if sown they are sure to establish themselves, whether the finer seeds do or not. Apparently a good plant of seeds is secured, but it is the sort of plant which should not be there ; and a heavy growth is obtained, but it has practically no feeding value. As a rule, the seed of Yorkshire fog is found with the outside husk attaching, and when magnified it looks like a small beech-mast of very light colour, as the shape is somewhat similar and the exterior has the same roughness. This roughness is not so apparent to the naked eye. The seed appears closely like beech-mast when cut in an unripe condition, and is more open, as it is riper. No portion of the attached stem is visible.

The kernel is covered with a fine smooth husk and is comparatively small.

Another seed found in badly-dressed samples of seed is that of the Onion Couch (*Arrhenatherum avenaceum bulbosum*). This is due to the fact that in many districts where rye-grass seed is grown the onion couch, as it is often called, is very commonly met with. It is very closely allied to, and is the only variety of the ordinary tall oat-grass, is a free-growing plant of fairly food feeding value, though this variety is poor in feeding properties. The seed is sufficiently distinct for it to be easily distinguished from rye-grass seed. It is very similar to the seed of the wild oat, but much smaller. The seed is attached to the stem at its base, consequently the broken piece of stem seen in many

grasses is not present. In colour it is usually rather brown at the back, and from the back, near to the base, springs a long stout awn, about twice the length of the seed. This awn is straight and spiral about half its length, after which it generally curves slightly. At the base of the seed there are numerous fine hairs, as in the wild oat. The seed appears shrivelled towards the top, where it comes to a somewhat sharp point.

The seed of couch-grass, scutch, twitch, and innumerable other local names (*Triticum repens*) is frequently met with in mixtures of rye-grass; in fact, it is found so frequently that a not uncommon idea prevails that rye-grass turns to twitch. The seed is larger than that of Perennial Rye-grass, and is

proportionately longer and narrower. It comes to a more acute point at the top, and the piece of stem adhering to the seed is nearly cylindrical. The inside edges of the husk are seen, when magnified, to be slightly hairy. The back is keel-shaped and comparatively smooth. It is usually, but not always, awnless.

Hassock-grass or tussock-grass (*Aira cæspitosa*) is prevalent in wet pastures. The seed does not appear very frequently in samples or mixtures, because it rarely grows on land where grass seed is cultivated but that of *aira flexura* is. It is most frequently found as an adulterant in samples of Rough-stalked Meadow Grass. It should be eradicated when it does appear; its presence is a sign of excessive moisture; consequently, superabundant moisture

should be got rid of by drainage. The tufts should be cut off by an adze to allow the better grasses to fill in. Some years ago I ploughed over about an acre of pasture which was largely composed of hassock-grass, and which would have cost a considerable sum to get rid of by ordinary methods ; this cut the top root, and leaving it exposed for a few weeks weakened it so that when the turf was turned back into its original position, the better grasses gained possession of the land and the hassocks entirely disappeared. I rather frightened the authorities by ploughing up an acre in the middle of a grass field, but a little reflection would have shown them that good, rather than harm, must result. It was quite sufficient for them, however, that it was against custom. A piece of

worthless ground was made as good as the rest of the field for the outlay of a few shillings spent in labour.

There are several varieties of Bent Grass (*Agrostis*), but only one Fiorin (*Agrostis alba*, *var. stolonifera*) is of value. The seeds of *agrostis* are very small, and in ordering fiorin the purchaser should be careful as to the honesty of the firm he is buying from, or a worthless weed will be sown instead of a more useful one. It is not much use to sow fiorin on any but moist soils; it does little good on dry soils. The risk of paying for poor seeds and getting a crop of weed is so great that it is hardly worth the risk.

Docks, both land and water, are objectionable in meadow land, as beyond being unsightly and useless as food, the

seeds are conveyed to other parts of the farm, thereby causing trouble. They should be got out by means of a docking iron—a fork with a ball on the underside at the top of the prong to lever them out of the ground. Sorrel is a sign of want of lime in the soil. It indicates acidity, which is neutralized by the use of lime. Daisies, moss, and other weeds common in poor pastures are present because of want of better manuring; except perhaps for a short time occasionally during winter, moss is not seen where the clovers are growing plentifully and the better grasses thrive. Daisies are met with on lawns where the grass has been cut and taken away for many years, and no manurial return made; or on poor pastures generally. They disappear to a great extent as the

soil becomes richer. Bone meal, superphosphate, kainit, and sulphate of ammonia as manures are the best means of getting rid of them, as the better herbage which they induce ousts them. Harrowing is useful in destroying moss, as it kills a portion which thus becomes converted into manure; but harrowing alone is not sufficient to permanently get rid of it. The cause of its existence remains until the soil is made more fertile. Harrowing and rolling act beneficially on grass by giving it the only cultivation possible without really disturbing the turf.

CHAPTER X.

THEORIES, EXPERIMENTS, AND PRACTICES RELATING TO PASTURES.

THE discussion of features which have been brought into notice on various occasions may now be profitably dealt with. One of the theories which attracted most attention was that known as the De Laune theory, in which it was urged that the want of success which so frequently attended the laying away of land to pasture was due to the fact that seeds of indifferent varieties of grass were sown, and a special crusade was made against Perennial Rye-grass, which was described

as being comparatively worthless. It was stated that "the grasses most pernicious to newly-formed pastures are first and principally rye-grass in all its varieties, and Yorkshire fog or soft, woolly grass (*Holcus lanatus*)."

As a matter of fact, Perennial Rye-grass is one of the most nutritious grasses we have, and, moreover, it forms by far the greater portion of the grasses found in our richest pastures; it is hardly beside the mark to say that it is the most prominent grass in all good pastures. It must not, however, be confounded with Italian rye-grass, which is of great value for temporary pastures, but useless to those which are to become permanent. In the thorough and careful tests which Dr. Fream carried out in connection with the herbage of old pastures, reported upon in vol. xxiv., part 2 of the Journal

of the Royal Agricultural Society, some striking facts were shown. Twenty-five sods were taken from the richest pastures of the United Kingdom and transplanted into garden soil. Care was taken that several inches of soil were left attached to each sod, so that there could be no admixture of soil or species of grass which would affect the results. As I saw these sods planted, and they were under my eyes up to the final examination, I am able to testify to the carefulness in every detail connected with the experiment, and the thorough reliability of the results obtained. In twenty-four out of twenty-five of these pastures rye-grass formed an important feature; but in the one from the county of Derby it did not appear at all. This, however, was admittedly one of the weakest

pastures tested, for it was previously described as being "not sufficiently strong to graze steers or oxen." Notwithstanding this, Perennial Rye-grass constituted 36 per cent. by weight of the grasses in twenty-five turfs, *Agrostis vulgaris* being next with 17 per cent. ; and no other grass was found to the extent of 10 per cent. In fifteen of the pastures rye-grass was found to the extent of over 75 per cent. of the total weight of grass ; and in only three was it less than the average of the next prominent grass in the series. This makes the case a strong one for Perennial Rye-grass, and indicates that it must be generally regarded as necessary.

It was urged very strongly by the supporters of the De Laune theory that Meadow Fescue (*Festuca pratensis*) should

form a large portion of the seed sown to form a permanent pasture, but in only three instances out of twenty-five was it represented, and then barely to the extent of 1 per cent. in weight on the whole. This was apparently a case of mistaken identity, the blades of rye-grass having been regarded as those of meadow fescue, to which there is some resemblance, though closer examination shows that the mid rib of the former is strongly marked, while it is scarcely discernible in the latter. The young blades striking up from the heart of the Perennial Rye-grass plant are folded flat, while in the case of the meadow fescue they are twisted round, appearing in a cylindrical form somewhat similar to those of Italian rye-grass.

The objection to Perennial Rye-grass

was formed because it grew too freely at first, but subsequently diminished in size. The fact is, rye-grass is highly nutritious and requires plenty of rich food to thrive upon. When land is first sown it eagerly takes up the food at its disposal and produces heavy crops during the first two or three years. By this time the available food becomes exhausted, and unless additional food in the form of manure is supplied, it cannot produce the growth it does under more favourable conditions. It does not waste its time, but turns to profitable account the food at its disposal, and this is what a grass ought to do. The first cuttings are very valuable, and because Perennial Rye-grass effects in two or three years what other grasses take several years to accomplish, this should not be regarded as a failing,

but as a point strongly in its favour. Rye-grass does not die out; it only becomes stunted in growth; apply suitable manure, and it will grow again as strongly as ever. However, many who sow rye-grass mow it, and take off the crop, returning little to the soil, and then find fault because it does not continue to grow as freely as at first. How can it? You cannot produce bricks without straw. It has been stated in a previous chapter that land carries the varieties of grasses which thrive under special conditions. When land is poor good grasses wane, and others of inferior feeding value, such as Yorkshire fog, thrive. This is well illustrated in a field sown with rye-grass. As the food supply becomes deficient, rye-grass gives way to inferior varieties.

The worst period in the life of a pasture is from the third to the tenth year, or a little longer, in accordance with the fertility of the soil. If liberally manured, the grass will grow freely every year, and produce good crops; if not, as is usually the case, it progresses slowly. Every year, however, adds something to the fertility stored up in the soil. The rootlets gradually die, and thus act as manure to succeeding generations of plants. The soil thus becomes altered in its consistency and texture. Such conditions are more favourable to the growth of Perennial Rye-grass; the stunted plants gradually gain vigour and increased fertility, as was shown in Dr. Fream's experiments. This may be confirmed by examining any rich old pasture; they take the most prominent

position among the grasses of the pasture. In examining a pasture to estimate its value the frequency with which the fresh green blades of rye-grass appear, and the vigour which they show, must be regarded as the most valuable guide. This is most important when white clover is found growing freely among it, for it is absolutely certain that when this combination is found, the pasture is one of exceptionally high feeding properties.

It has been shown that rye-grass is a profitable grass only when there is a fair amount of fertility in the soil, and other grasses are profitable only when the same conditions prevail. At the same time it is advisable to sow a small quantity of seeds of other good grasses, so that they may be present to take

advantage of conditions which may be specially favourable for them. Even in the best pastures other good grasses beyond Perennial Rye-grass are met with, and it is advisable to give all a chance.

In the making of a pasture it is particularly important to encourage the development of clovers. Clovers naturally enrich the soil, and add to its fertility by taking nitrogen from the atmosphere. Grasses take their nitrogen from the soil. The difference is significant. It has for a long time been recognized that the clovers "come" in an old pasture, and that they do this gradually. At first when sown they grow freely for a year or two, and then, like rye-grass, they grow less freely. The reason is the same—the food they most require becomes exhausted. The manure most

essential to the growth of clovers is of a very different nature to that of grasses. A large quantity of nitrogen is required for the development of grasses, while it has little effect on clover. Lime and potash are of first importance, because without the clovers they cannot abstract from the atmosphere the requisite nitrogen. Clovers and all leguminous plants are provided with small nodular growths on the roots, and these are small laboratories inhabited by minute bacteria which have the power of extracting nitrogen from the air; but these little workers require lime and potash to carry on their work. Without them they starve, and as they supply no nitrogen to the plant it cannot make growth; on the work of the bacteria depends the existence of the clover plant. It is

therefore essential that these manures shall be supplied if the land does not contain sufficient within reach of the plants. As nitrogen is the most expensive element in manures, the advantage of getting the clover plant to work on behalf of the farmer is easily understood. The amount of nitrogen thus absorbed enters the plant, and if that plant is consumed by animals, a large portion of it is returned to the soil as food for the grasses; but a considerable portion of the nitrogen is stored in the clover roots, and as these die, that stored in them also becomes available. It is found that it is much more easy to get a permanent pasture on good soils where lime and potash are available than on other soils, and it is the presence of these which greatly regulates the power of land to

“take to grass.” Loams in which there is a liberal supply of lime take readily. Sandy land with little lime is slow, and the pasture is with difficulty made to produce food for strong cattle. Thin chalk soils with an ample supply of lime, but with little potash, produce weak pastures, as shown on Down land. Heavy clays which possess lime and potash in abundance, if well drained, can be made to carry good pastures, though the mechanical condition is not so favourable as where the soil is somewhat lighter, as on heavy loams. Want of drainage, however, destroys the chance of good pastures.

As soils rich in nitrogen carry grasses of higher feeding value than do those which contain but little, so soils rich in potash and lime carry more valuable

clovers than those deficient in them. Thus on a rich pasture white clover is met with in considerable quantity, while on poor soils, and on new pastures from their third to the twelfth years, the small trefoils are most commonly found. These lowly trefoils must not be despised, as they are doing the work of storing up nitrogen from the atmosphere, and when the soils become richer they will give way to the white clover. It is of course better that the soil should be well stocked with plant food suitable for both grasses and clovers, as then both will produce heavy growth, and the root formation will be proportionately greater. The reason why feeding off pastures, instead of mowing the crop and taking it away, is obvious. The advantage of

feeding cake on it is equally readily seen, especially in the case of rich food such as cotton cake, which contains a large percentage of nitrogen and potash.

Pastures are economizers of nitrogen in yet another way. A considerable quantity of nitrogen in combination is brought to the ground every year, being carried down by rain, dew, and snow. This varies according to the situation with regard to the presence or absence of large towns, whose chimneys vomit out huge quantities of smoke containing nitrogen in different forms. An average of analyses made in nine places in different parts of Europe showed that as much as 10.23 lbs. of nitrogen were brought down on to every acre. As little as 1.86 lb. per acre was measured at one station, and over 20 lbs. at another. At Rothamsted

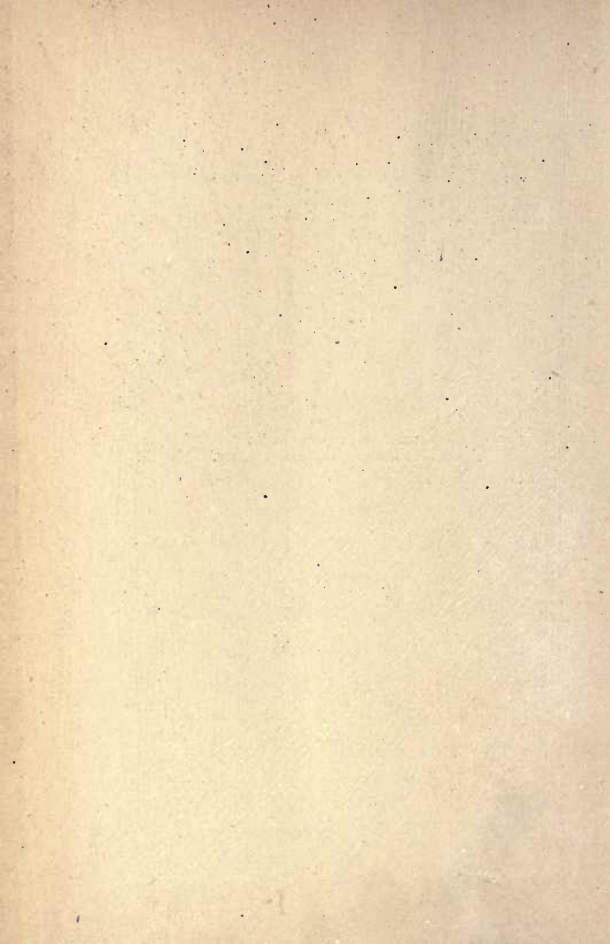
it is about 4 and 5 lbs. As there are $15\frac{1}{2}$ per cent. of nitrogen in nitrate of soda, the equivalent of about 70 lbs. of nitrate of soda falls where 10 lbs. of nitrogen are thus brought down. This, of course, falls on arable land also, but arable land is more wasteful of its nitrogen, no inconsiderable portion being washed out in drainage. Pastures waste but little in this way; the roots ramify the soil in every direction, and the humus has an effect in retaining the nitrogen. It is for these reasons that such full results are obtained when manure is applied to grass land.

A serviceable work was done by the supporters of the De Laune theory in calling attention to the fact that some of the larger growing grasses are possessed of considerable feeding properties. An

idea prevailed among many that only the finer varieties were highly nutritious. So many of the coarse grasses, such as Yorkshire fog, the brome-grasses, &c., possess but little feeding value, and all tall or coarse growing grasses were entered in the category. Three of those specially advocated, Meadow Fox-tail, Cat's-tail, Cock's-foot, are well worth encouraging in situations where they are likely to thrive. The prejudice against coarse grasses, however, affects them when it is desired to sell the hay, which deteriorates from their value for mowing.

THE END.

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